SCIENTIFIC AMERICAN

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THE ATLANTA EXPOSITION.

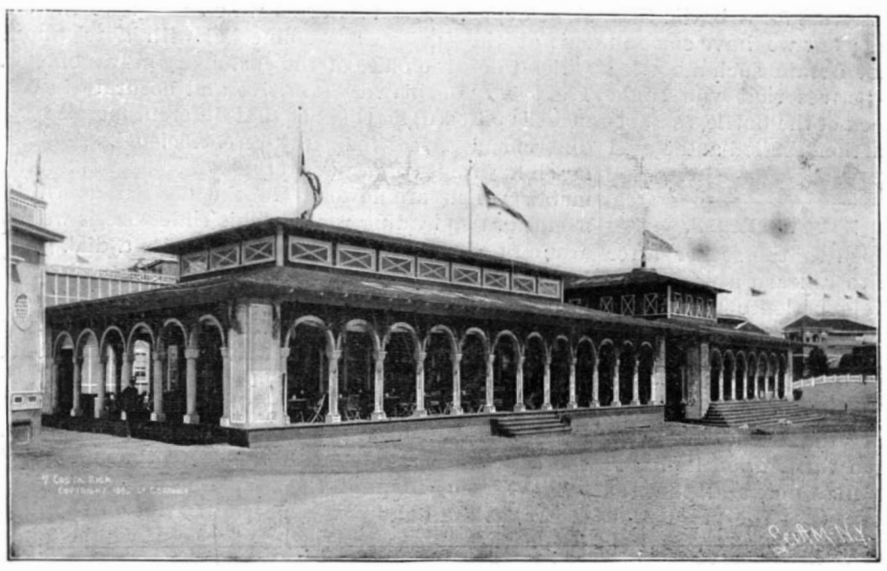
Among the successful means employed to draw visitors to all the great expositions have been the naming of special days for different cities and States, thus inciting local enthusiasm in the bringing together of people from such localities. "Manhattan Day," or the day specially set apart at the Atlanta Exposition for citizens of New York, occurred on Monday, November 25.

The Costa Rica building, shown in one of the accompanying illustrations, is located in one of the least obtrusive parts of the exposition grounds, near the Plaza. The architectural features, as will be seen, are national in their outline, the main building being surrounded by a broad, sun protecting piazza, the long lines of whose roof are broken by successive arches and supporting columns. In addition to national exhibits, many of the dishes and beverages of that country are served.

In another view we show an interior of the main hall of the Fine Arts building. There are three halls for exhibiting works of art in this building, the one herewith shown being devoted to statuary. The exhibits include work in marble, bronze, staff, etc., from heroic to miniature in size. The walls are also hung with drawings, photographs, paintings, etc. An entrance door to one of the other halls, devoted to paintings, is seen in the background.

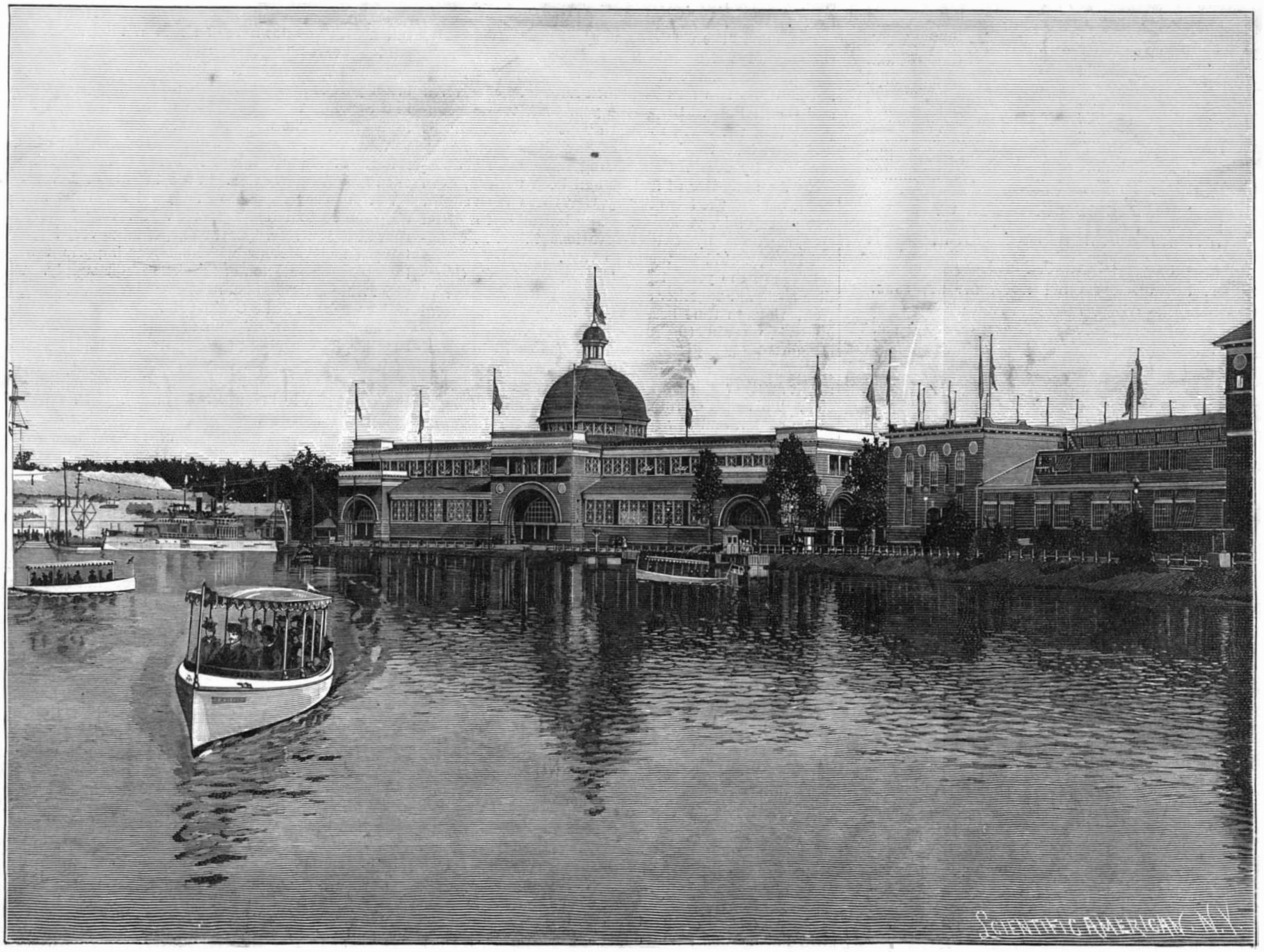
One of the finest views of the Electricity building is

(Continued on page 344.)



COSTA RICA BUILDING.

STATUARY HALL—FINE ARTS BUILDING.



THE ATLANTA EXPOSITION—ELECTRICITY BUILDING, LOOKING ACROSS CLARA MEER.

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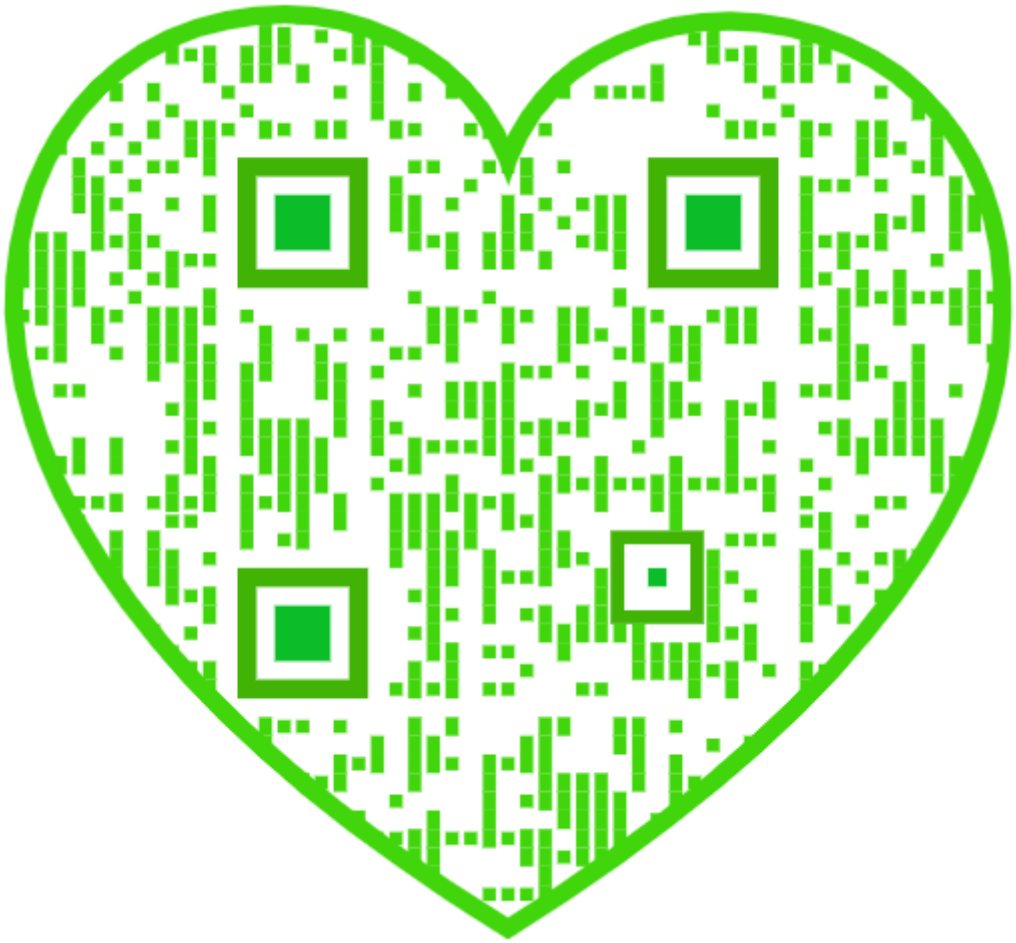

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THE BOTTLE THAT CANNOT BE REFILLED.

We published not long ago a quotation from one of our city papers, in which the statement was made that a large reward had been offered by wealthy distillers and brewers for the production of a new invention, such as that above mentioned, namely, a bottle which, after the contents have been extracted, cannot be again refilled. The article we alluded to stated that distillers suffer great losses from the refilling of their bottles by unauthorized persons, who imitate both bottles and trade marks of standard makers without detection.

We have been unable to trace up the alleged offer of reward to any reliable source and think it doubtful if it was ever positively made. But there is no doubt the invention is needed and would command a handsome figure, if all the conditions could be realized and a non-refillable bottle could be produced adapted to the general wants of the trade. As an evidence of this we give an extract of a letter recently received by us from the proprietors of one of the largest whisky establishments in the country. This letter reached us during the progress of our search to find the offerers of the alleged great reward:

"In reply to your favor, we beg to state that we have been in the market for years for a bottle that could not absolutely be refilled; but we have come to the conclusion that we cannot obtain such a bottle; for if a bottle was made so perfect that you could not refill same through the neck of the bottle, the bottle could be drilled or cut, and then refilled and closed so as to avoid detection."

LATITUDE NOT FIXED, BUT VARIABLE.

It will now and again happen to the seeker after knowledge that he will have to unlearn as well as to learn; but it will be a rare experience for him to have to call in question such a supposedly fundamental truth as that of the invariability of the earth's latitude.

If there is one fragment more than another of our childhood's "geography lesson" that abides ever with us, it is this: that "the earth turns upon its axis." And now we are told that it does not, and that, as a consequence, it is literally true that the parallels of latitude are perpetually shifting—not much, it is true; but sufficiently to make it comically possible, as was once suggested, that certain dwellers in the proximity of the Canadian border line never know for more than six months together in which country they live.

The axis of the earth, or, to speak more accurately, the axis of the earth's figure, is an imaginary line, passing through the center of the earth, and terminating at its two flattest points, known as the North and South Poles. Up to the year 1888, it was supposed that the earth rotated about this axis. If this had been true, the latitude of any given spot, as determined by observation, should have been invariable. As a matter of fact, it had been noticed, even as far back as the last century, that there was a slight, but perceptible, variation. The latitude of a given spot, as shown by two observations taken at different times, would be found to vary.

Between the years 1884 and 1888, Dr. S. C. Chandler gathered together all the observations that had from time to time been made, and, after a careful analysis, was able to prove that these variations are accounted for by the fact that the earth does not rotate about its axis of figure, as above described, but about another axis, which he called the axis of rotation. This axis of rotation bisects the axis of figure at its center, and always preserves the same direction in space; but its poles slowly describe a circle about the poles of the axis of figure. From this consideration it is evident that the parallels of latitude do not preserve the same planes relative to space; but have an oscillatory motion. Hence the variation.

The motion is fairly well illustrated by a spinning top, whose center of gravity remains in the same vertical line, while the peg and the head describe two circles about this vertical line. The motion of any parallel lines on the top will roughly approximate to the motion of the lines of parallels of latitude on the earth's surface. The above illustration will only approximately show this motion of the earth, for the reason that the latter is complex, being made up of two superposed motions. The pole of rotation moves in a small circle which is itself moving around the pole of the earth's figure.

The period of the smaller circle is between 423 and 434 days; that of the larger between 361 and 369½ days.

The radius of the smaller circle is 14 feet. The center of the circle itself travels in an ellipse, the major axis of which is about 25 feet, and the minor about 8 feet.

A remarkable verification of Dr. Chandler's discovery was afforded by a series of tidal observations extending over 35 years, two of which were taken on the Pacific Coast and one on the Atlantic. These show a mean time of oscillation of the sea's level of 431 plus or minus 4 days, which agrees remarkably with the period of revolution as mentioned above. Newcomb had pointed out that if the theory of the revolution of the axis of rotation were true, low tide at any spot should occur when the pole of rotation lay nearest that spot—a suggestion with which the above tidal observations fully agree.

THE TEMPERATURE OF LAKES.

According to Desmond Fitz Gerald, M. Am. Soc. C. E., in a paper recently read at the annual convention of the society, the observation of the temperature of the water in lakes and reservoirs is attended with more difficulty than is generally supposed. Hitherto the taking of readings at any considerable depth has been rendered difficult and tedious on account of the unsuitability of the ordinary mercurial thermometer for such work. The invention of the thermaphone by Messrs. H. E. Warren and O. C. Whipple enables the observer to take in a few minutes a more accurate reading than was formerly possible after an hour's careful work.

The thermaphone is based upon the principle of the Wheatstone bridge, and it enables the temperature to be read at the surface of the water, the two metals which form the circuit being suspended at the desired depth. The two arms which complete the circuit at the surface are connected with a telephone which takes the place of the customary galvanometer. The theory of this very sensitive and accurate instrument is based upon the fact that different metals have different electrical temperature coefficients. A circular slide wire is connected to the two coils of dissimilar metal, which are lowered to the desired depth by means of two leading wires. This slide wire is wound around the edge of a disk, which carries a dial, graduated in degrees of temperature. A leading wire connected with the junction of the two metal coils connects with a telephone receiver and terminates in a radial contact arm, which travels upon the above mentioned disk. The ends of the slide wire are put in circuit with a battery. In reading the temperature, the radial contact arm is moved back and forth over the dial, and the telephone is held to the ear.

The buzzing sound in the telephone increases or decreases as the hand passes a certain point on the dial. By continually moving the hand, a point will be found at which the sound ceases altogether. The reading at this point indicates the temperature of the distant coil.

"This instrument is so accurate that its results can be depended upon to much less than 0·1° F., and a series of temperatures throughout the vertical can be taken with an allowance of about a minute for each point observed."

Surface Temperatures.—During the winter, from the latter part of December to the breaking up of the ice in the spring, the temperature of the water under the ice is 32° F. The water then warms at a uniform rate to 72° F. in the middle of June. From that time to the middle of August it varies between 73° and 78°, and then falls regularly to 37° in the middle of December.

Bottom Temperature.—In a pond less than 25 feet deep the bottom temperature varies very little from that at the surface. In the deeper lakes very interesting phenomena occur, which have an important bearing upon the question of domestic water supply. The observations were taken in connection with the Boston water works at Lake Cochituate.

The point of maximum density of fresh water is 39·2° F. This is about the temperature of the bottom of the lake when the surface freezes. "The several strata lie in their order of density, decreasing gradually until within a few feet of the surface, when they suddenly fall to the freezing point adjoining the ice." The body of water remains unchanged throughout the winter. At the breaking up of the ice, the surface water warms up to the temperature of the bottom layers; the whole body is thrown into "unstable equilibrium," and circulation takes place from top to bottom. As soon as the surface is 5° F. warmer than the bottom, circulation ceases. Although the temperature of the surface continues to rise, "the bottom remains at exactly the same temperature throughout the long period of stagnation," covering about seven months, during which time it varies only a few tenths of a degree. From this it is evident (1) that the agitation set up by the winds at the surface does not penetrate very deep (experience shows fifteen feet to be about the limit); (2) that there are no convectional currents at work to effect a change of temperature; and (3) that water is such a poor conductor of heat that the hottest sun's rays are not perceptible at the depth of sixty-five feet.

Weekly observations of temperature in Lake Cochituate for a period of four years show that the surface agitation by the wind keeps the water at an even temperature for the first ten feet of depth, and that below fifteen feet the effect is very slight.

The Effects of Stagnation.—The deeper, quiescent layers of water gather the organic matter from the waters above, and "decay goes on until the oxygen is used up." The water becomes dark in color and acquires a disagreeable smell.

Commenting upon these facts, Mr. F. P. Stearns

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stated that these lower strata of water, which are unable to get any fresh supply of oxygen from the air, accumulate free ammonia and other solid and gaseous products of decomposition. Hence it is desirable that the domestic supply should be taken from near the surface and waste water drawn off from the bottom. In this way the evil effects of summer stagnation may be partly overcome and the whole body of water improved at the autumnal overturning.

It is possible in the summer to sink a bottle to the bottom of Lake Cochituate and bring up ice-cold water, and, at the same time, fill another bottle with water from the surface that is 80° in temperature. In view of this great difference in temperature and the purity of the surface water, the author of the paper suggests that any one living near a deep lake could obtain very pure ice-cold water during the summer months by taking it from the surface and leading it through a coil of pipe placed in the cold stratum of water at the bottom.

Observations of Lake Superior, taken in August, show a bottom temperature of 38·8° F. in 158 fathoms, the surface temperature being 50° to 53° F.

Prof. Le Conte, in August, 1873, found Lake Tahoe, in California, to be 39·2° at 1,506 feet; 41° at 772 feet, and 67° at the surface.

Nine soundings, taken in Lake Thun, in 1848, to a depth of 550 Swiss feet, show a mean temperature of 40·7°.

The Lake of Geneva, which is 1,000 feet deep, shows a mean temperature of 41·2°, as the result of seven years of observation.

As the result of his own and other observations, the author arrives at the conclusion that "in a lake of the first order, like that of Geneva, the winds produce a mechanical mixture of the layers to a considerable depth below the surface;" "the smaller the lake the less these mechanical effects are felt," "but that this heating is not due to conduction seems to be proved by the fact that, at 65 feet depth, conduction has no effect in seven months' time on the bottom temperature of Lake Cochituate."

THE HEAVENS IN DECEMBER.

The first hours of a December night witness a visible brightening of the eastern heavens upon the entry of Orion and his splendid neighbors Taurus, Auriga, Gemini and Canis Major. One of the finest pageants that Nature affords to the contemplative observer is the vast procession of these starry magnificoes of the sky. Whenever they are visible there is nothing on the earth or in the dome that can take precedence before them. I should be very sorry if my memory could ever lose the impression that they made upon my eye and mind one morning before sunrise on the peak of Etna, last September. Even the great crater on whose broken edge I stood, with its strange fires glowing and moving mysteriously in the depths, and the immense circle of the horizon sweeping 800 miles across sea and land, were spectacles less commanding than that of Orion and his company sentineling the purple-black heavens.

This is a good time, before the heavy snows of midwinter have rendered the out-of-door use of a telescope inconvenient and uncomfortable, to study the starry treasures that cluster in the constellations just named. The Pleiades in Taurus and the Hyades, forming the V-shaped figure in the same constellation, are superbly beautiful objects for the opera glass. Is Aldebaran, the chief star in the Hyades, and one of the most beautiful anywhere in the sky, rose red or orange red? That is a question about which observers differ, and every amateur not color blind is entitled to have an opinion of his own concerning the color of that great sun in Taurus, a sun far grander than our own.

Look with a three-inch telescope at the bright white star Rigel in the foot of Orion and enjoy the sight of its little blue comrade. Try ζ, the left hand star in the Belt of Orion, with a little larger telescope. It has a companion whose color is one of the curiosities of the sky, but just what that color is nobody, apparently, knows. The distance between the two stars is about 2·5″, and their magnitudes are 3 and 6·5. And do not neglect the Orion nebula hanging below the belt, an object whose interest for astronomer, or wayfarer among the stars, never becomes less. Auriga, too, has many telescopic beauties which lack of space prevents my describing, but to which such a book as Webb's "Celestial Objects" gives a clew, and Gemini presents to us the wonderful twin Castor, yielding its duplicate charm to the smallest telescope.

Jupiter is still the only planet conveniently situated for observation. It is in Cancer, a few degrees southeast of the cluster of stars called the Beehive, and, about midnight, will be found half way up the eastern slope of the Zodiac. Not much that is new concerning Jupiter has been learned of late, but the unceasing and evidently violent changes that its surface undergoes lend value and interest to all careful observations of its appearance in the telescope.

Venus continues to adorn the morning sky, but, having attained her greatest western elongation at the end of November, she is now approaching the sun again. On the 1st she is about five degrees from Spica, or α Virginis, and at the end of the month she will be in Libra, near the borders of Scorpio. She will be near Saturn in Libra on the 22d, and for a few mornings before and after that date, and the conjunction should be a sight worth getting up before sunrise to see.

Mercury is in the eastern edge of Libra at the beginning of the month, moving sunward, and on the 20th the planet will pass behind the sun.

Mars is also in the eastern part of Libra and too near the sun for satisfactory observation. At the close of December it will be among the star clusters of southern Ophiuchus.

Saturn, on the 1st, is about 2° north of α Libræ, rising near 5 o'clock in the morning. At the end of the month it will rise soon after 3 A. M.

Uranus is near Mars at the beginning of the month, and will remain in Libra, being in conjunction with Venus on the 28th.

Neptune is still between the starry horns of Taurus, rising in the afternoon and crossing the meridian in the middle of the night.

December opens with a full moon, the phase occurring early on the morning of the 2d, when the moon is in Taurus. Last quarter occurs on the morning of the 9th in the constellation Virgo. December's new moon falls on the 16th, about 1:30 A. M., first quarter following in Pisces on the morning of the 24th, and the second full moon of the month occurring on the evening of the 31st in Gemini.

The moon passes the planets on the following dates: Neptune on the 2d; Jupiter on the 6th; Venus on the 12th; Saturn on the 13th; Uranus on the 13th; Mars on the 14th; Mercury on the 15th. This rapid series of conjunctions of the moon with Venus, Saturn, Uranus, Mars and Mercury shows, in a striking manner, how those five planets are just now strung along the zodiac in the morning sky.

The sun enters Capricorn and the astronomical winter begins about 8 P. M. on the 21st. It is noticeable that the astronomical seasons accord better with the character of the weather than do those of the civil almanac.

GARRETT P. SERVISS.

Calvert Vaux.

Calvert Vaux, the eminent landscape architect, died in Brooklyn, N. Y., November 21.

He was born in London, December 20, 1824, and was educated at the Merchant Tailors' School, afterward studying architecture under Lewis N. Cottingham. At the suggestion of Andrew J. Downing he came to this country in 1848, became Mr. Downing's partner, and was engaged with him in landscape gardening and architecture, the firm having laid out the ground surrounding the Capitol and the Smithsonian Institution at Washington.

Afterward Mr. Vaux became associated with Frederick Law Olmsted and with him presented a plan for the laying out of Central Park in this city, their design having been accepted after competitive examination, which had been suggested by Mr. Vaux. During the work upon Central Park Mr. Vaux was the consulting landscape architect of the Department of Public Parks. His reputation as a landscape architect was then firmly established, and when Prospect Park was laid out in Brooklyn, in 1865, it was after designs made by his firm. Subsequent to this the firm designed the public parks at Chicago and Buffalo and the State Reservation at Niagara Falls. Mr. Vaux was afterward appointed landscape architect in the Park Department in this city, and with Mr. Olmsted prepared the plans for Riverside and Morningside Parks, as well as for the many small parks which were authorized by the Legislature, and are now in process of preparation. He was probably the best known landscape architect in this country, and was consulted as an expert in matters of that kind by architects all over the country.

In addition to his landscape work, Mr. Vaux designed many country residences in Newport and elsewhere, as well as public buildings in this city; the Belvedere, the graystone tower which stands at the lower end of the reservoir in Central Park, being a specimen of his work. He also published an architectural book entitled "Villas and Cottages."

A Great Bell.

At a few minutes past nine o'clock, October 30, the casting of the great bell for the tower of St. Francis de Sales Church, Cincinnati, began, and the flow of metal was continued for about two hours before the work was completed. It is the largest bell in the United States, and fifteen tons of bell metal were used in the casting. In addition to this, the clapper, which is already cast, weighs 640 pounds. The main dimensions of the bell are: Diameter of the ring, 9 feet; diameter of crown, 5 feet. It is 7 feet high. Swung in the tower, the bell is to cost $10,000. For illustrations of the mode of casting such bells see SCIENTIFIC AMERICAN of September 7, 1895.

Cycle Notes.

Bicycle Law.—Summing up the law pertaining to bicycles in a general way, it may be said:

1. Municipal corporations or cities are liable to a bicyclist for injuries incurred by reason of defective roads (namely, unguarded embankment, a deep rut, a large stone), provided he is not guilty of contributory negligence. A city is under no special obligation to wheelmen, and the defect must be such as to cause injury to vehicles in general. A bicyclist injured while riding on Sunday for pleasure or business cannot recover in States where "Sunday laws" are in force.

2. A wheelman has a right of action against the driver or owner of a vehicle who willfully or negligently causes a collision or damages his wheel while left standing by the street curb or roadside. It is the duty of a wheelman, however, to avert collision if possible, and he cannot recover damages if his own negligence is the proximate cause of the injury complained of.

3. A traveler riding on the left hand side of the road probably assumes all risk, and is prima facie guilty of negligence.

4. Vehicles going in the same direction, the hindermost may pass on either side.

5. Sidewalks are exclusively for foot passengers, but a foot passenger has a right to walk in the highway, and is entitled to cross the street where he may elect, but is guilty of negligence if he attempts to cross ahead of a vehicle. And the fact that a vehicle is on the wrong side of the road is no evidence of negligence in an action for injury to a pedestrian.

6. A bicyclist employing an immoderate rate of speed on a highway or street may be liable civilly or criminally in case of accident. If he recklessly runs his wheel against a pedestrian, he is liable for assault and battery. Recklessness will sometimes supply the place of criminal intent, and if a bicyclist kills a human being while going at a dangerous rate of speed he may be convicted of manslaughter.

The term "immoderate rate of speed" cannot be accurately defined. It depends upon time, place and circumstances.—Detroit Free Press.

The list of royal cyclists is now so lengthy as to represent every European court, and with the exception of the Princess of Wales and the King of the Belgians, each of whom rides a tricycle, the word "bicyclists" may be substituted for "cyclists."

In the British royal family the list includes the Duke and Duchess of Connaught and their daughters, the Princess Louise (Marchioness of Lorne), the Princess Beatrice, who has only recently learned to ride; the Princess of Wales, the Duchess of Fife, the Princesses Victoria and Maud of Wales, the Duke of York and Princess Victoria of Schlesweig-Holstein, eldest daughter of Prince and Princess Christian.

On the Continent there is no better friend to cycling than the King of the Belgians, who takes the most paternal interest in the wheelmen of his dominion.

The Emperor of Germany has just betaken himself to the pastime, and other crowned bicyclists are the King of Portugal, the King of Spain, that daring huntress the Empress of Austria, the King and Queen of Italy, the King of Greece, and last, but not least, the Czar and Czarina, for whom two tandem bicycles have been made in Nottingham, England.

Of Continental princes and princesses devoted to the bicycle, the list would savor of the Almanach de Gotha.

The bicycle craze has invaded the precincts of the Supreme Court of the United States. A member of this august tribunal may be seen almost daily spinning down the asphalt streets of Washington.

The foremen of the New York Department of Street Cleaning have been mounted on bicycles to facilitate their inspection of the streets.

In Brookline, Mass., a sign reading as follows greets the weary rider: "Wheelmen will find drinking water at the right of the church."

Out in the fields of a suburb of Brooklyn, a land improvement company has erected a comfortably covered shed with racks for wheels and a large ice water cooler.

The new Hudson County Boulevard, in New Jersey, opposite the great city, is accessible to New Yorkers, and affords a fine fourteen mile run.

Commercial travelers who do not require to carry many samples are using the bicycle in Texas, as they do not have to wait for trains between towns.

Australia imported $400,000 worth of bicycles from England last year.

A correspondent in the L. A. W. Bulletin presents the following formula as a proper mixture of oil for lamps: Take a bottle which will hold a pint, fill it two-thirds full of the best lard oil, and the balance with headlight oil, also add a piece of gum camphor about the size of a small egg, which, being broken in small pieces, easily dissolves. This preparation gives a nice white light, does not char the wick, and will not jolt out.

Folding wooden or wicker crates for bicycle transportation can be purchased in Paris for one franc.

The tenth anniversary of the safety bicycle was celebrated by a banquet in London, a short time ago.

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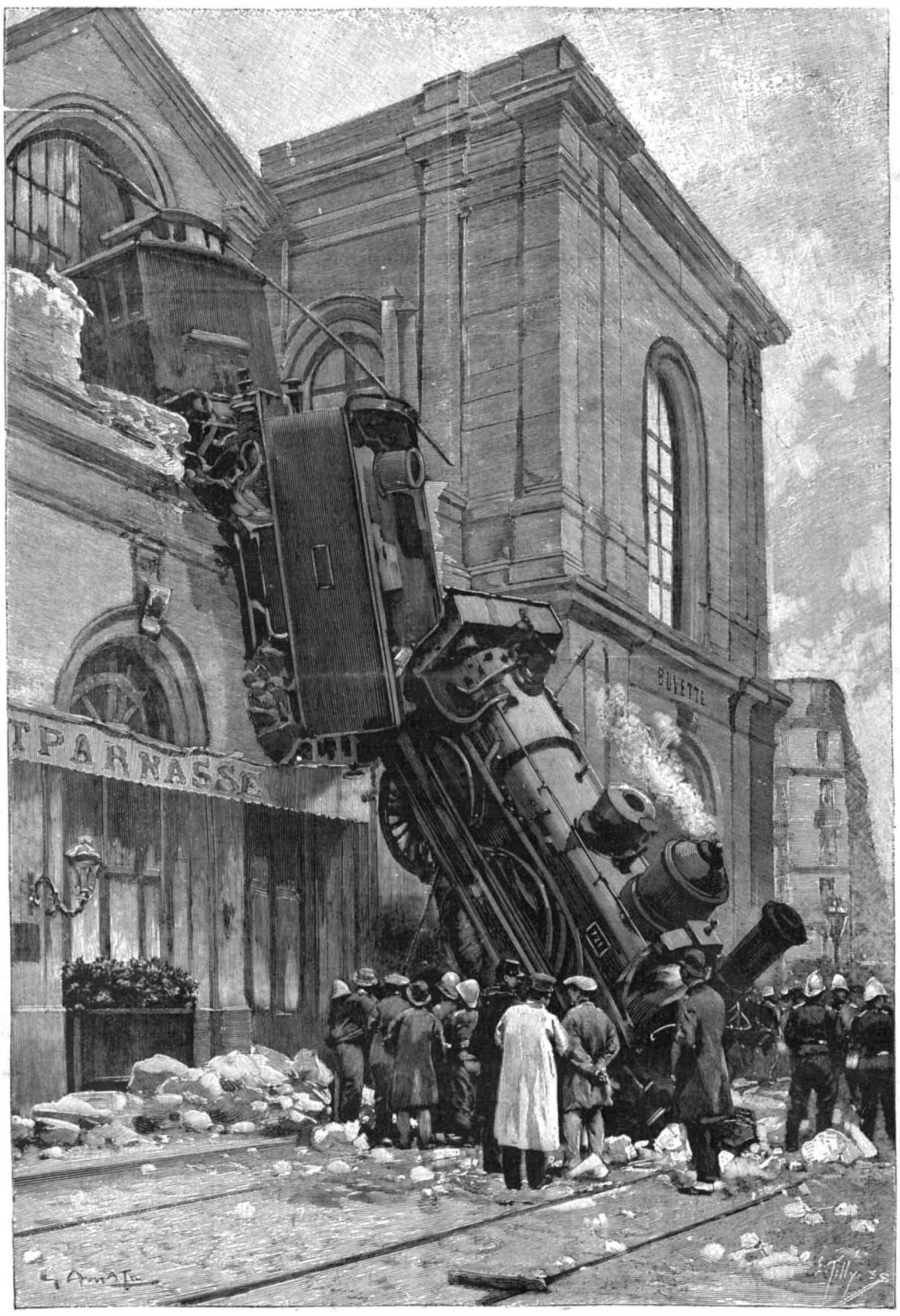
A FRENCH RAILWAY ACCIDENT.

An extraordinary railway accident occurred at the Gare Montparnasse, Paris, at 4 P. M. on the afternoon of Tuesday, October 22. The train from Granville entered the station at a speed of 30 to 35 miles an hour and was not able to stop. The station has two stories, the train house being in the upper story. The engine and tender crashed through the wall at the end of the station and fell to the street (Place de Rennes) below, a distance of 30 feet. Thanks to the Westinghouse brakes, which were applied by the conductor, all of the railway carriages were saved from being precipitated into the street. The one hundred and twenty-three passengers were considerably shaken up, but were not otherwise injured. The engineer and fireman were thrown from the engine and were not seriously injured. The only fatality was the case of a newswoman, who was killed by a piece of stone from the wall. The engine narrowly escaped a horse car and three loaded omnibuses. Crowds lingered in front of the station for hours.

Inquiry was made into the cause of the disaster. The master machinists attributed it to the failure of the brakes to work. Engineers were forbidden to use the Westinghouse brake when entering terminal stations or stations provided with a bumper at the end of the rails, hand brakes being used for all ordinary purposes, the Westinghouse brake being reserved for emergencies. For our engraving, which was taken from a photograph, we are indebted to L'Illustration.



A RECENT RAILWAY ACCIDENT IN PARIS.

New York Cut Flower Company.

After entering the wide hall of the spacious building at 119 West Twenty-third Street, New York, the visitor is carried by the elevator to the second floor and ushered into the commodious rooms of the New York Cut Flower Company. The first glimpse of the main salesroom, even at a quiet hour of the day, suggests a large and multiform business; in a busy time the visitor finds himself suddenly among the largest collection of cut flowers on this continent. A moment is needed to collect himself after the burst of color and gale of fragrance which greet him, and then he will see substantial broad white tables ranged along the sides of the room and set in parallel rows between them, with generous floor spaces reserved for salesmen and buyers. Every day of the week this room presents an animated scene, for, even on Sunday, in the early morning, exceptionally energetic Christian buyers are on hand for the freshest and most fashionable flowers for decorating houses of worship. On the continuous broad tabling along the walls stand large boxes of roses as they come packed by the growers. The contents of others are deftly arranged in great heaps on the tables in front, which serve as counters. Other parts of the salesroom are used for carnations, violets, lilies, mignonette, smilax, lily of the valley, with its poetical name here, as elsewhere, in the flower trade, cruelly abbreviated to "valley," with other flowers in season.

Passing into a middle room, which at this season is reserved exclusively for chrysanthemums, a new effect is witnessed. On side tables masses of immense flowers are grouped in deep mahogany-colored vases made of "Fibrotta," a preparation of wood pulp with a hardened shell and glazed surface. These tumbler shaped vessels are eighteen inches deep and nine inches across at the top, but their ample size is needed for the tall stout stems and the weighty flower heads they support.

In the middle of the room the floor is closely covered with open boxes, each containing twenty-five chrysanthemums—the long stems and their dark luxuriant foliage nearly filling the boxes, which are four feet or more long, half the blooms being at each end of the box, and especially choice and tender flowers separately wrapped in tissue paper. Last week in a collection whose quality suggested an exhibition for effect and for premiums, choice specimens of the new white Mayflower were, perhaps, the most sensational flowers. This variety and Nemesis, resembling the Daybreak carnation in its delicate pink color, commanded the highest prices of all. Flowers of Major Bonnaffon were also conspicuous among the best stock, and so were those of Philadelphia, the favorite new seedling of 1894.

The third room of this immense floor, which, in its length of two hundred feet, reaches entirely through to the Twenty-fourth Street front, is in a way even more interesting than the others. This apartment, which is not open to the public, is the receiving depot. A powerful elevator lifts the boxes after they are deposited on the first floor at this end of the building, where they are brought by immense vans direct from the growers' establishments or by express wagons from railroad stations. The boxes measure about five feet in length and six inches in depth. Many are made of wood, the corners protected by zinc strips, and other metallic-looking ones, two feet deep, are of heavy glazed papier maché, iron bound and securely strapped. The boxes are at once opened, the flowers examined and graded according to established standards, and a credit slip made out in the shipper's name, with memoranda of the kind of flowers, the number received, and whether of the first, second or third grade. The flowers are then passed into the salesroom or stored in great refrigerators, which are ranged along one side of the receiving room in unbroken lines and have altogether a capacity of nearly five thousand cubic feet.

The New York Cut Flower Company, of which this is the home and business center, is an organization new to this industry. It is not a trust, and does not attempt to regulate business of its members, but it is a combination of some fifty commercial cultivators, who joined together to sell their products to wholesale buyers direct, instead of shipping, as heretofore, to commission houses. It has been estimated that the flowers sold on commission in this city in a year have a total value of one million dollars. If this is double the real sum, the fifteen per cent charged by commission merchants would even then amount to $75,000, and the combined growers thought they could get their flowers to the retailers for less money. At all events, they can now know definitely about the sales of their stock, and if reports come back to the effect that it is unsalable for some reason they can investigate the matter, as they could not do when the flowers had been sold on the old plan. The company includes members from this State, New Jersey, Pennsylvania, Connecticut, and Rhode Island. More than ninety per cent of the members use above twenty thousand square feet of glass, and some have glass houses which cover a hundred thousand feet. Many members are stockholders, and those who are not sign certain co-operative contracts, in which they agree to sell all their flowers through the company.—Garden and Forest.

Power Required for Electric Traction.

In an article in the Sibley Journal of Engineering, Mr. James Lyman gives the results of a number of tests made in different cities of the power required for electric traction. At Rochester, where the first of Mr. Lyman's records were obtained, there are about 20 miles of track which was in good condition at the time of the test. The number of cars on the road was 40, each weighing about 8 tons, and provided with a 15 horse power geared motor. In general the road was level, but in the heart of the town there were some gradients of from 3 to 4·7 per cent. Moving on the level, the necessary tractive power averaged 38 lb. per ton of car, and for the whole run over the four principal routes at 6·5 miles per hour, the average horse power was 1·4 per car, and the maximum 6 horse power, this latter only being used momentarily.

At Buffalo the same average power was required, but the maximum was 6·6 horse power. In a large Western city a car with the axles coupled direct to the motor, without the intervention of gearing, took 0·92 horse power per ton on the average, with a maximum of 4·7 horse power. In wet weather the tractive power required is reduced, the rain acting as a lubricant. Wetting of the rails round curves is particularly effective, the requisite traction power being thereby reduced by one-third. Comparative experiments made at Ithaca, N. Y., showed that on gradients the tractive force required exceeds that on the level by more than the theoretical amount.

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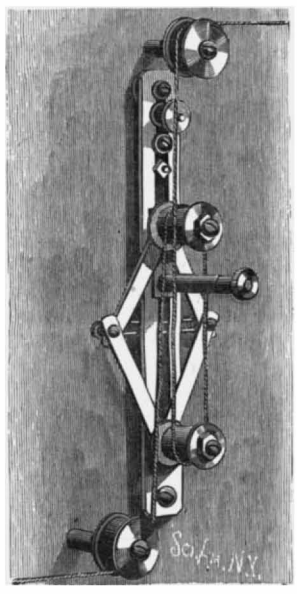
A STEAM ENGINE INDICATOR STOP MOTION.

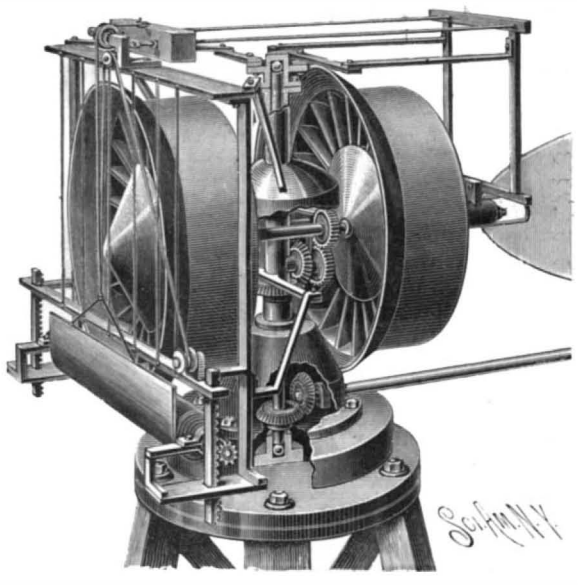
To readily stop the motion of the paper drum of an indicator, to change the cards or for other purposes, without disconnecting the operating cord the improvement shown in the accompanying illustration has been patented by Henry J. Parchman, of Cedar Falls, Wis. A frame is secured to the engine or other support, near the cord connecting the pantograph with the indicator, and on the frame are studs carrying pulleys around which the cord passes, one of the studs being mounted on a slide moving in a slot in the frame, the slide being locked in adjusted position by stops, one of which has a handle to facilitate moving the stop in the slot. The cord, after leaving the pantograph, not shown, passes under a pulley and around the pulleys on the frame, and thence over another pulley to the indicator, so that the several pulleys are rotated on the forward and backward movement of the cord. On one of the studs on the frame are fulcrumed levers pivotally connected with other levers fulcrumed on the other stud, a spring connecting the central pivots of the levers, and having a tendency to draw them together against the pull of the operating cord. While the cord is to positively connect the pantograph with the indicator, the slide is locked in place on the frame, but when the card is to be changed or the indicator stopped, a stop is loosened, permitting the slide carrying a stud and one of the pulleys to slide in the slot in the frame, the pull of the operating cord then drawing the levers toward each other in the opposite direction, against the tension of the spring. A yielding connection is thus introduced to compensate for the movement of the cord without affecting the indicator, the device working with indicators of any make, at any speed and in any postion.



PARCHMAN'S STEAM ENGINE INDICATOR STOP MOTION.

AN IMPROVED WINDMILL.

The windmill shown in the accompanying illustration is designed to utilize the force of the wind to the greatest advantage, and to automatically shut off the wind from the wheels should its velocity become too great. The improvement has been patented by Hubert Schon, of Allegheny, Pa. On a vertical shaft set on a ball bearing is a bevel gear connection with the driving shaft, and on the upper end of the vertical shaft is the ball bearing of a frame supported by the shaft, there being journaled in the frame a horizontal wheel shaft carrying front and rear wind wheels. Each wheel has an inner and an outer rim, between which are the wings or blades, and each inner rim is closed at its front end by a cone, while a hood is attached to the front of the outer rim, to gather the wind and direct it to the blades. The vertical shaft is connected by beveled gears with the horizontal shaft, and

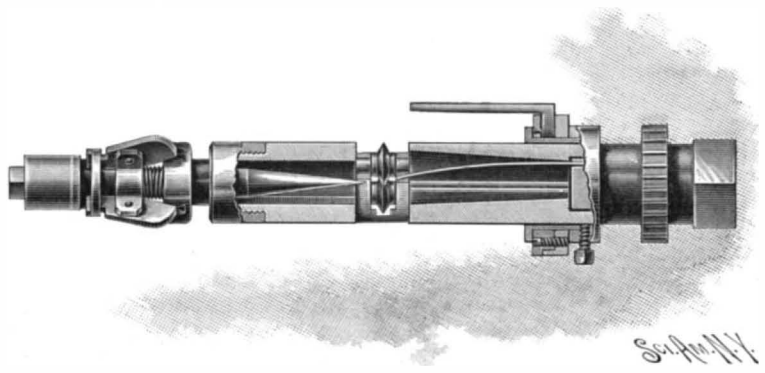


SCHON'S WINDMILL.

from the rear end of the latter extends a vane to hold the wheels to the wind. To regulate the speed of the wheels, a curtain or apron is mounted as a roll below the bottom of the hood of the front wheel, the pulling up of the apron cutting off the wind from the wheels. Attached to the upper edge of the apron is a rope which extends upward over a pulley and is connected with a governor that slides longitudinally on guide rods on a skeleton frame, the governor being in the form of a box adapted to be driven rearward by the force of the wind, thus lifting the curtain or apron. Weighted racks acting on toothed trunnions on the curtain shaft counterbalance the governor and draw the curtain down when the wind decreases. To shut off the wind from the wheels at any time, a second rope is connected with the curtain, enabling the operator to raise it when desired.

A TUBE OR PIPE CUTTER.

For cutting boiler tubes or pipes, the device being firmly held in place while the work is being done, and the cutters having an automatic and positive feed, the improvement shown in the accompanying illustration has been patented by Patrick H. Benade, of Punxsutawney, Pa. The device comprises two aligned cylinders connected with each other at their ends by rods on which are journaled frames each carrying a cutter wheel. A cone with a longitudinal feather engages a keyway in one of the cylinders, the cone having a threaded shank engaged by an internally threaded sleeve which has on its outside a right and a left hand thread, on which screw nuts, levers carried on one of the nuts engaging inclined grooves on the other nut. When the tool is placed in a pipe, and a wrench is applied to the head, causing the cylinders to revolve, the nuts on the sleeve screw toward each other, causing the levers on one of the nuts to travel up the incline of the other nut, as shown at the left in the illustration, the free ends of the levers thus moving into firm contact with the inner surface of the pipe or tube. The continued turning of the cylinders then causes the shank of the cone to screw in the sleeve and feed the cone forward in engagement with the frames carrying the cutting wheels, which are carried around and fed outwardly as the turning continues. The turning of the tool in an opposite direction causes a withdrawal of the cutters and return movement of the cone, with a final release of the clamping levers from the inner surface of the pipe. On the outer cylinder is a gage with gage fingers adapted to set the cutters to the proper point at which the tube or pipe is to be cut off, the fingers resting against the end of the boiler, and being adapted to open and close, that they may be kept as close to the tube as possible loosely, the tool being adapted to cut several sizes.



BENADE'S TUBE OR PIPE CUTTER.

What All Boys Should Know.

Don't be satisfied with your boy's education or allow him to handle a Latin or Greek book until you are sure that he can—

Write a good legible hand.
Spell all the words he knows how to use.
Speak and write good English.
Write a good social letter.
Add a column of figures rapidly.
Make out an ordinary account.
Deduct 16½ per cent from the face of it.
Receipt it when paid.
Write an ordinary receipt.
Write an advertisement for the local paper.
Write an ordinary promissory note.
Reckon the interest or discount on it for days, months, or years.
Draw an ordinary bank check.
Take it to the proper place in a bank to get the cash.
Make neat and correct entries in day-book and ledger.
Tell the number of yards of carpet required for your parlor.
Measure a pile of lumber in your shed.
Tell the number of bushels of wheat in your largest bin, and the value at current rates.
Tell something about the great authors and statesmen of the present day.

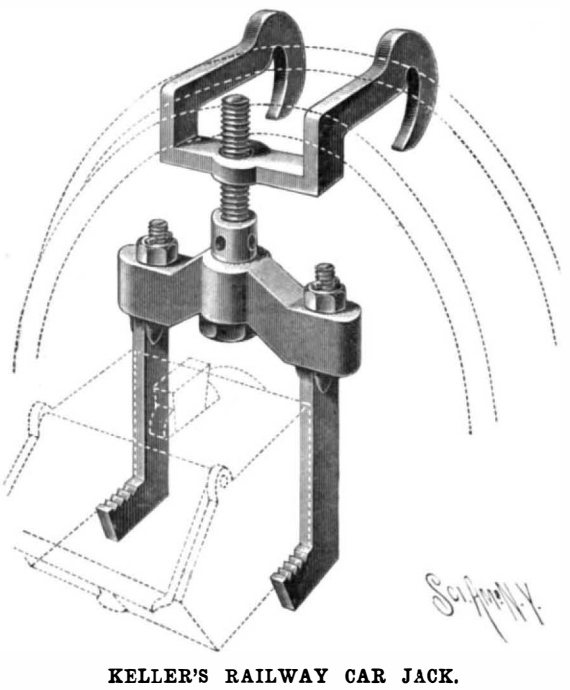
If he can do all this, and more, it is likely he has sufficient education to make his own way in the world. If you have more time and money to spend upon him, all well and good—give him higher English, give him literature, give him mathematics, give him science, and if he is very anxious about it give him Latin and Greek, or whatever the course he intends pursuing in life demands.—School Supplement.

Engineers' Licenses.

Under a new law, all engineers in charge of power or heating plants in Massachusetts must be licensed, and in order to be licensed, they must pass an examination, arranged by the State authorities. Although enacted last winter, the law only went into operation in August, and the examinations are now open to candidates, who, if the daily papers are to be believed, do not take much satisfaction in them. It will be remembered that the supervising architect of the Treasury Department once wanted some assistants, who, either under the civil service laws or some special provision, were to be selected by competitive examination. The examination was held, but, if we remember rightly, not one of the applicants could pass it, and it was necessary to fill the positions in another way. So with the Massachusetts engineers, as we are told. The examination is a long one, some fifty or sixty questions being proposed, to which written answers must be given; and it appears that the questions are mainly theoretical, involving principles which can be learned from books, but which working engineers have little occasion or opportunity for studying. The consequence is, as we are told, that the first-class licenses will go to youths fresh from the technical schools, who know all about heat units and calorimeters, but would have considerable difficulty, on starting the engine under their care, in finding the valve for draining the water out of the cylinders, even if the propriety of this operation should occur to them; while the men who have handled engines intelligently and successfully for twenty or thirty years are, as we are informed, in danger of being deprived of their livelihood because they cannot solve a mathematical problem involving the solution of a quadratic equation. How much foundation there may be for these complaints, we cannot say, but it would certainly be a mistake to undervalue experience in such examinations. Of course a man who has greased a locomotive successfully for twenty years might blow up a heating boiler at the first trial; but on the other hand, algebraic formulas cannot teach the light hand and quick eye of a good mechanic; so that such examinations should be arranged to test both the theoretical knowledge and the practical intelligence of the candidate, and great skill on the part of the examiner is necessary for this.—Amer. Architect.

AN IMPROVED RAILWAY CAR JACK.

A device especially designed to facilitate removing and replacing worn-out brasses in the journal boxes of



KELLER'S RAILWAY CAR JACK.

car axles, or for raising the box without disturbing the position of the wheel on the track, is shown herewith, and has been patented by Daniel A. Keller, of Rincon, New Mexico. The jack is shown in perspective in full lines in the illustration, its position on the car wheel relative to the journal box, when in use, being indicated by dotted lines. Transverse hooks, adapted to engage the top of a car wheel, are formed integral with a threaded cross bar, in which screws a screw rod, on which is hung a cross bar with depending angular arms, adapted to engage the under side of a journal box. The device affords a square lift, preventing cramping of the journal brass at any point. The power is applied at a point about fourteen inches above where it is applied on the ordinary pony jack, and the device can be set and used at ordinary passenger platforms. The inventor claims to be able, with this jack, to raise a journal box in one-fourth the time taken with the usual appliances, doing the work with less labor.

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THE NEW PORT OF COPENHAGEN.

Copenhagen has so old a history as regards maritime commerce that it seems strange to hear a new port of this city spoken of, and yet it is really the case that it has just been provided with an entirely new one complete in every part. It is a question of a free port which has been excavated in order to permit Danish commerce to vie with the influence of the maritime canal that the Germans are now giving up to exploitation between the Baltic and North Seas. We have already spoken of this latter enterprise, and have shown not only the military, but the commercial purpose that it is to satisfy. It is a question of diverting the trade that has hitherto been carried on through Cape Skagen, and of putting the German ports of the Baltic in direct relation with the ocean, or at least of making Hamburg the great entrepot of the consumers and dealers of the Baltic. It is therefore desired to take from Copenhagen the brilliant role that it has hitherto played.

Established in part upon the island of Seeland and in part upon that of Amagar, commanding the Sund, and, on each side, even, of one of the arms of this strait, this city has very naturally, for ages, been acquiring a very great importance. As may be seen from a simple glance at a map of Northern Europe, it has a preponderant situation. It is the natural metropolis of the Baltic and the center of the transactions of the north. This port is upon one of the most frequented maritime routes in the world. The fact is that Copenhagen, or, to use the true Danish word, Kjobehavn, has developed in an extraordinary manner. In 1870 its population was but 181,000 inhabitants, while at present it reaches and even doubtless exceeds 400,000 souls. As regards the traffic properly so called, while in 1857 there were but 10,045 sail vessels on the list of entries and 9,905 on the list of clearances (vessels which at that epoch were but of small individual tonnage), the sole movement with exterior ports comprised, among the list of entries, 6,151 sailing vessels, gaging 233,394 tons and carrying 219,290 tons, and 6,449 steamers, gaging 1,763,133 tons and carrying 781,590 tons. The clearances were 6,045 sailing vessels, gaging 229,024 tons and carrying 40,433 tons, and 6,527 steamers of a gage of 1,858,000 tons and carrying 231,037 tons. In truth, the port was no longer, with the new conditions of maritime navigation, adequate for such a movement. Not only were the mechanical installations defective therein, and the entrance channels of little depth, but the utilizable surfaces were very limited. In reality, this port was formed only of a narrow passage between the islands of Seeland and Amagar, as may be seen in any plan of Copenhagen. There were indeed, under the protection of the fortifications, many basins for small boats, and canals ramifying throughout the city, but for large ships there were but a few docks in inadequate basins in the northern part of this passage. It was in the Oresund, between the coast of Seeland on the one hand and the fort of Three Crowns and that of Lunette on the other.

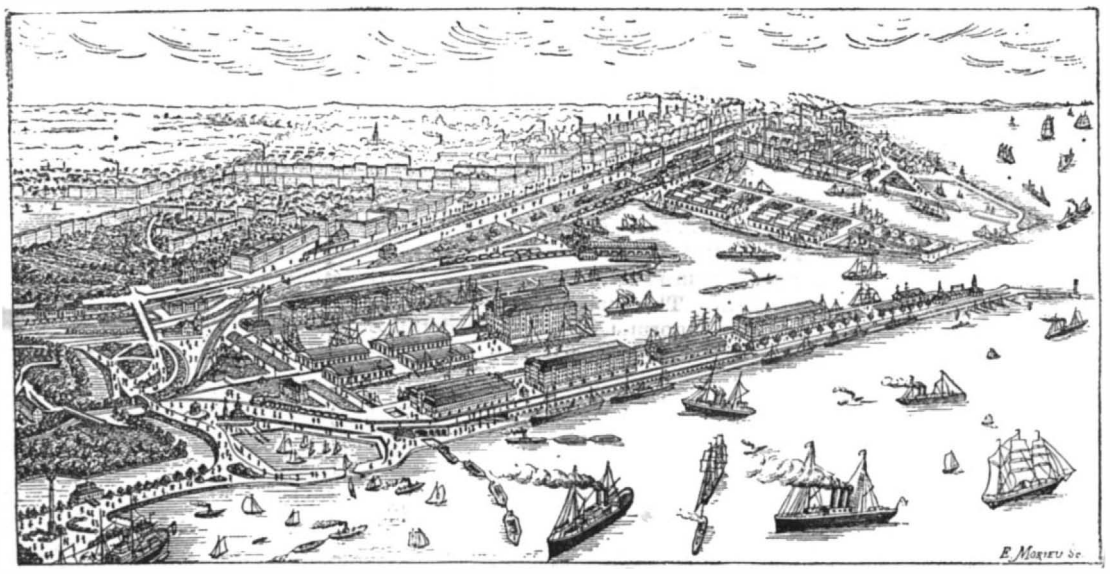
It is true that about ten years ago the "Limekiln Basin" had been dredged, with a small annex basin wholly to the north of the Oresund, but this had improved nothing, since this basin was very isolated, without ways of communication, and presented at a maximum an inadequate depth of 7·53 meters.

A reform was necessary, and became obligatory when the Kiel Canal was begun, since, if something was not done quickly and energetically, the situation of Copenhagen would be lost forever. In March, 1891, there was decided upon the construction of a free port presenting all the advantages of such establishments and designed to become a place of entrepot under the best conditions possible. This work was rapidly brought to a happy termination, and the port was opened at the end of 1894. It cost at least $3,500,000, three of which were furnished by the Port Commission, which constructed the basins, wharves, platforms, railways, and buildings, and the rest by a commercial company especially organized for the exploitation of the port. The latter is established upon ground entirely submerged between the glacis of the citadel and the Limekiln Basin, with which it even unites in part under the name of the Southern Basin. We shall say nothing of the old port of Oresund, which was, however, dredged to 8 meters. The new port opens opposite the fort of Three Crowns through a channel of 106 meters, 9 meters deep, protected by a great breakwater of 400 meters, and bordered to the south by a jetty which, like the breakwater, is of blocks of concrete. Upon entering, we meet with the southern basin, which is 471 meters in length and 188 in width, but only the southern and eastern banks of which form part of the free port. At the side is situated the central dock, which has a depth of 7·53 meters. The point of the wharf that separates it from the southern basin presents two indentations in the form of careening docks in which land the ferryboats of Malmo. At this point we perceive a railway station that permits passengers to pass directly from the cars to the ferryboats or vice versa.

The southern basin skirted by the large eastern mole (the one that is seen in the foreground of our engraving and that separates it from the Oresund) is divided into two docks by a terreplein 314 meters in length by 56 in width. The western one of these is but 8·22 meters in depth, while the rest of the basin is 9·14 meters. The large eastern mole, which is 940 meters in length up to the jetty, does not belong wholly to the free port, being divided lengthwise nearly in the center by the grillage that completely surrounds and isolates the grounds of the port. The method of executing the work was quite interesting, everything having been reclaimed from water, and the terrepleins rising from depths as great as 4 meters. A portion of the wharves are of granite, and certain of them of piles faced with metallic plates.

Railways intersect all the wharves, which possess a superficies of 36 hectares and a length of 3,660 meters. They connect with the Danish system. The sheds and stores are numerous, are provided with elevators, and are constructed of fireproof materials. At the southwestern corner of the great southern basin there is a central station of electricity that distributes power to the elevators, cranes, etc., installed upon all the wharves, and that afford a profusion of light everywhere. We must not forget a vast grain elevator 38 meters in height and 50 in length provided with carrying belts, the offices for the brokers, the dormitories for the laborers, and the storage warehouses for the ships. The Port Society has the right to issue warrants upon the merchandise deposited.

What will doubtless permit of the great development of the new port is that the charges are reduced to a minimum. A ship of 1,000 tons will have to pay but 252 crowns, while the charges formerly amounted to 1,843. It must be taken into consideration, too, that Copenhagen is but very rarely frozen in, and that the entrance to it is always possible, the tide being almost null. Some German companies have already installed regular services between America and this port as the head of the line, and the Danes flatter themselves that they will see their magnificent maritime establishment become for Northern Europe the general entrepot of the products of America and Western Europe.—La Nature.



BIRD'S EYE VIEW OF THE NEW PORT OF COPENHAGEN.

A Famous Hair Lotion.

The Pharmaceutical Journal states that the original formula for the so-called Dr. Locock's hair lotion is: Expressed oil of mace, 4 ounces; ol. olivæ, 16 fluid ounces; liquor ammoniæ fort., 16 fluid ounces; spirit rosmarini, 32 fluid ounces; aquæ rosæ, to 2 gallons (imperial). The lotion was first prescribed by Mr. Alexander, the celebrated oculist, for his wife, and it proved successful. Dr. (afterward Sir Charles) Locock, being an intimate friend, introduced it first in his own family, and afterward recommended it extensively among his numerous lady patients—hence the name. The art of dispensing the lotion consists in thoroughly beating up the expressed oil of mace with a wooden pestle, adding the olive oil in fairly large quantities at a time, and very small quantities of strong ammonia to saponify each such addition. Toward the middle of the process the oil of mace assumes a granular appearance of a reddish color. Should it not do so, or should the mace be converted into a gelatinous mass, further manipulation may be abandoned, for the resulting emulsion will separate. When all the olive oil has been incorporated, add the rose water freely, then the spirit of rosemary, and finally the remaining portion of the ammonia. It will be found that the amount of liquor ammoniæ fort. necessary in the first instance will not exceed 4 fluid drachms. The cream color of the lotion is produced on adding the remaining portion of the ammonia, and the emulsion so made will keep permanently without a sign of decomposition or separation. Twenty minutes should be the time occupied in manipulation.

Scientific Teaching as to Alcohol.

Evidence as to the action of alcohol upon the human body has been collected, not by hysterical prohibitionists, but gathered from the laboratory, the autopsy room and the bedside. One series of facts opening a decidedly new field has been obtained through the works of the experimental psychologists. Through the efforts of some of these gentlemen—and we may mention particularly work done at the Heidelberg University—it seems to be established that alcohol has an effect in dulling simple mental processes, such, for example, as learning by rote, simple arithmetical calculations, and the simpler association of ideas. Another series of facts which tend to show the evident effects of alcohol is that which have been collected by students of heredity, particularly the relation of heredity to degeneration in families. The French alienists, in particular, have shown that one of the most prominent of the factors in leading to the development of mental and physical degeneration is the use of alcohol, and it is further urged by these investigators that alcohol has more than an individual or family effect, that it produces serious deterioration of the human race.

Of course, the effects thus claimed are all due to the abuse and excess of alcohol. Whether a further and more careful investigation would show that a moderate use of alcohol leads, eventually, to somewhat similiar results, we cannot say. As regards the evidence against alcohol furnished by clinicians and pathologists, there has really been nothing particularly new added in late years. But if one take an unbiased survey of the position of medical knowledge and of medical men toward alcohol, and compare it with that held by them fifteen years ago we feel sure that he will see that the feeling against the use of it is much stronger. This is because there has been a gradual accumulation of facts carefully ascertained and thoroughly proved, demonstrating the ill effects of the drug. It is for the reason that the position of medical men regarding the use of alcohol has been always conservative and never fanatical that the present slight shifting of the front deserves the attention of our law makers and of all of those citizens who are interested in good government and in the social problems of the day.

Ancient Glass Makers.

The glass blowers of ancient Thebes are known to have been as proficient in that particular art as the most scientific craftsman of the same trade of the present day, after a lapse of forty centuries of so-called "progress." They were well acquainted with the art of staining glass, and are known to have produced that commodity in great profusion and perfection. Rossellini gives an illustration of a piece of stained glass known to be four thousand years old, which displayed artistic taste of high order, both in tint and design. In this case the color is struck through the vitrified structure, and he mentions designs struck entirely in pieces from one-half inch to three-quarters inch thick, the color being perfectly incorporated with the structure of the piece, and exactly the same on both the obverse and the reverse sides. The priests of Ptah at Memphis were adepts in the glass maker's art, and not only did they have factories for manufacturing the common crystal variety, but they had learned the vitrifying of the different colors, and the imitating of precious stones to perfection. Their imitations of the amethyst and of the various other colored gems were so true to nature that even now, after they have lain in the desert sands from two thousand to four thousand years, it takes an expert to distinguish the genuine articles from the spurious. It has been shown that they used the diamond in cutting and engraving glass. In the British Museum there is a beautiful piece of stained glass, with an engraved emblazonment of the monarch Thothmes III, who lived 3,400 years ago.

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Sand and Cement.

As a contribution to the literature upon the subject of strength of mortar as influenced by the size of the particles of sand used in mixing, Mr. A. S. Cooper, United States assistant engineer, recently published a description of tests made by him to compare fine beach sand with the coarser varieties in the Journal of Franklin Institute, from which the following extracts are taken.

During the construction of a mining casemate at Fort Pulaski last year, the question arose as to the advisability of using fine beach sand instead of coarse river sand, on account of the greater cost in obtaining the latter. The writer took the position that the fine sand would be nearly as good, in fact good enough, and as its employment was estimated to save at least $1,000 in the total cost of the work, a short series of experiments was made, which, to the astonishment of all connected with the work, proved the fine sand to be slightly stronger than the coarse. These results were spoken of as being opposed to those obtained by all previous experimenters, and this fact induced the author to investigate the question in a more thorough and scientific manner.

The first matter to be settled was the method of working in order to eliminate as many uncertainties as possible. Where close figures are to be expected, a slight inaccuracy in the work might lead to erroneous conclusions. After looking over all of the different methods, the following were finally adopted as being the most suitable for this work.

The sand was first graded by means of thirteen sieves, ranging from 8 to 140 wires to the lineal inch, and the grades indicated by the two sieves used. The grade 8 12, for example, means that the sand in this grade passed a sieve with eight wires to the inch, and was held by one with twelve wires. It was concluded to mix the mortar rather dry, about the consistency of moist snow, so as to be able to handle the briquettes immediately after moulding them. It was also believed that a dry mortar would give more even results under uniform pressure than a wet one. The sand and cement were first carefully weighed, then they were mixed dry by means of a square box with a rod run through the corners, after the manner of General Q. A. Gillmore's concrete mixer. The water was measured with a graduated glass, and mixed into the cement and sand on a stone table with a trowel. If the mortar appeared too dry, more water was added, and if too wet, note was made of the fact, and the set proceeded with. In nearly all cases enough mortar was made at one mixing to make eight briquettes. Four of these were broken at the end of a week, and the remainder in eight weeks. As a difference of one per cent of water in the finished mortar could not, in all cases, be detected, a series of tests was made to determine the effect of such variations. The results proved conclusively that slight variations in the amount of water might cause considerable differences.

It should also be borne in mind that some cements and some sands of the same size require more water than others to yield a mortar of the same consistency. Generally speaking, fine sand requires more water than coarse, and natural cements more than Portlands. The briquettes were moulded in brass moulds of the form recommended by the committee of the American Society of Civil Engineers in 1885, but were not pressed in by hand as recommended by this committee. The method used by Professor Charles D. Jameson was adopted. Professor Jameson put his mortar into the moulds under a uniform pressure of 150 pounds per square inch, while in this work 200 pounds was used. The press consisted of a simple lever arranged in such a manner that when pressure was applied nothing but vertical pressure would be transmitted to the briquette.

Generally speaking, the coarser the sand, the stronger the mortar made from it; but the difference between the grades below 30-40 are so slight that, as far as sizes are concerned, they might be considered in one class. There seemed to be a tendency toward an increase in strength with grades below 100-120, but so few samples of these grades were obtained that this slight increase may be put down as accidental. There is an unmistakable indication of weakness in the upper grade, 8-12.

It is apparent that the specific gravity of all of the various kinds and grades of sand tried are not materially different, and that, therefore, the difference found between the weights of equal volumes are principally due to the different percentages of voids. It is further apparent that the smaller the grade, the greater the percentage of voids in loose sand, and vice versa; while in well packed sand there is practically no difference in percentage of voids. These results indicate that uniformity of mortar briquettes for tests can be obtained only by either measuring the sand while well packed or by weighing.

Conclusions.—(1) Other things being equal, coarse sands are better than fine sands for cement mortar up to the grade 12–16, or about $\frac{1}{12}$ of an inch in diameter. (2) Below the grade 40–50, or about $\frac{1}{40}$ of an inch in diameter, there is no practical difference in the value of the different sands, as far as the size is concerned. (3) The shape and condition of the surfaces of the grains of different sands has as much to do with their value for cement mortar as the size.

New Power Plant of the Niagara Falls Hydraulic Power and Manufacturing Company.

In view of the efforts being made to utilize the rapids of the St. Lawrence and the Ottawa along the shores of the island of Montreal, for the purposes of supplying power and electric lighting to manufacturers and others, the following description of the power plant now being constructed by the Niagara Falls Hydraulic Power and Manufacturing Company will be of interest to the public.

The hydraulic basin from which water is now taken for furnishing power to the various mills supplied with power by this company is located parallel to and about 300 feet back from the edge of the high bank of the Niagara River on the Canadian side. For this new plant the water will be taken in an open canal from this hydraulic basin to a forebay 30 feet wide and 22 feet deep, which is now being built near to the edge of the high bank. From this forebay, penstock pipes built of flange steel, eight feet in diameter, conduct the water down over the high bank 210 feet to the site of the power house on the sloping bank at the edge of the water in the river below the falls.

The site for the power house is now being cleared; broken and disintegrated rock mixed with huge bowlders which have fallen over the bank in past ages covered the site in places to a depth of 75 feet. The work of clearing this material from the site of the power house, which is now nearing completion, has been largely done by means of a giant or monitor. This is the machine so extensively used in the gold mines of the West for excavating by means of a stream of water. The machine in use at this point is the first used in the East. Below this debris is a stratum of Medina sandstone, on which the power house will stand.

The building will be 60 × 100 feet, the intention being to add to the length of the building (60 feet) and place other wheels, fed by separate penstocks, from the same forebay as above as demand arises. There are four turbine wheels of the horizontal type, furnishing about 8,000 horse power to be located in the first floor of the power house. These wheels will work under a head of 210 feet, the highest head under which water has ever been used for power in the quantity proposed in this plant. The pressures exerted by water under this head are enormous, and every detail of the penstock and waterwheels must be designed with the greatest care to hold it.

The penstock leads from the forebay vertically about 135 feet to the top of the sloping bank, thence down the slope to the side of the station next to the bank, making the total length of the eight foot pipe about 240 feet. Into the building the pipe, 10 feet in diameter, runs horizontally suspended over the tailrace. The thickness of the steel is fifteen-sixteenths of an inch. All horizontal joints are butt strapped, held with three rows of rivets on each side. The cross seams are all double riveted. The necessity for strong work in this pipe will be seen when it is remembered that the total pressure on the end of the pipe exceeds a million pounds. From this horizontal portion of the penstock the water is taken directly up through 60 inch valves on to the waterwheels, which are supported upon iron beams stiffened by braces into the side of the tailrace. The four wheels for this plant are being built by James Leffel & Company, of Springfield, Ohio, under general plans and specifications made by the engineer of the Niagara Falls Hydraulic Power and Manufacturing Company. Three of these turbines are specified to generate each seventeen hundred horse power under a head of 205 feet, which is the minimum head estimated as obtainable, and to run at a speed of 250 revolutions per minute. As the ordinary head will be from 210 to 215 feet, the power of these wheels will be from 1,800 to 2,000 horse power each.—Canadian Journal of Commerce.

Queer Kinds of Spectacles.

Spectacles, to enable the user to see objects near at hand or at a distance, are made in a variety of forms. In a common form the glasses are in two parts, joined at the center, the upper halves being of a power suited to distance and the lower halves to reading. Sometimes a piece is cut out of the glass and a piece of a different power is put in its place. Sometimes the variation is made by cementing a wafer of glass over a part of the spectacle glasses, and sometimes by grinding away a part of the spectacle glasses. There are made also spectacles with crescent-shaped glasses, the upper part of the glass being cut out entirely; the wearer reads through the glasses and looks over them to see at a distance. There are spectacles called clerical glasses, that are like glasses with the upper halves cut off; the wearer looks down through the glasses to read, and he can see over them without effort when he looks at the congregation.

Poisons of Putrid Fish.

In a short article, incorporated in the Bull. U. S. Fish Commission recently issued, Dr. J. Lawrence Hamilton points out the connection between foul fish and filth diseases. Beginning with cholera, he notes the outbreak of this disease in 1893, in the fishing ports of Grimsby and Hull, and instances cases of deaths which occurred from mussels, cockles and oysters from those infected ports.

It is well known that fishing populations, from their slovenly and dirty habits, are more prone to endemic as well as epidemic affections. The author refers to Astrakan, the seat of the sturgeon and caviare industries, as a case in point. Statistics show that the population of this place would become extinct were it not recruited from external sources. During the winter of 1878 79, the plague devastated the place, and the worst and most fatal cases were among the laborers employed in fish salting, who live under very miserable conditions. The price of bread being beyond their reach, they subsist chiefly on the leavings of the inferior parts of the prepared fish. Formerly, government rules enforced that the unused remains of the prepared fish should be thrown directly into the water, but now these, collected and accumulated in masses, are left to rot in and about the banks of the rivers under the heat of sometimes an almost tropical sun. The local atmosphere is further vitiated by many fat boiling, fish oil, isinglass, etc., works. During the five years preceding the outbreak of plague in 1878, enteric fevers, measles and smallpox were epidemic, while scarlet fever raged in 1876-77. Previous to 1878, the town of Astrakan, during 22 years, had suffered from nine epidemic attacks of cholera and three of enteric fever.

Such skin diseases as elephantiasis, ichthyosis, and beri-beri are suspected of being produced by a combination of fish, filth and poverty.

Wounds caused by the handling of decomposed fish are often very serious. The author gives a list of such cases. The Norwegian whalers take advantage of this fact by using prepared putrefactive poisoned harpoons. The whales are driven toward shore, surrounded by a net to prevent escape, and then struck with the poisoned harpoons. After twenty-four hours they show signs of exhaustion, probably through septic poisoning, and are readily captured. The harpoons are recovered and carefully preserved, without wiping, for future use.

The importance of the question of putrid food cannot be overestimated; hence the author's strong language in urging a better supervision of the fish markets. Especially does he condemn the practices of leaving fish ungutted and unbled until sold, and of keeping fish soaked and sodden with water to make the skin look bright.

The foul condition of the boats, and of the boxes in which the fish are shipped to market, and the unsanitary condition of Billingsgate Market, are described in disgusting detail, and suggestions are given for, at least, mitigating these evils.

The infection of fish by impure preservatives, such as ice made from impure water and dirty salt, and also bacterial infection, are referred to. In this connection the author remarks that "the cleanliness in the United States caviare factories is unknown in southern Russia, the home of astounding dirt and disease, augmented by the most hideous poverty and ignorance."

It has been supposed that prolonged soaking would render diseased animal food innocuous, but it would seem, from the experiments conducted by Prof. Pamem and again by Dr. Brenton, that the vitality of poisons derived from putrid and other animal matter, though weakened, is not destroyed by boiling. Accordingly, to avoid all possible danger of the use of condemned food, the author recommends that it be burnt in properly constructed local furnaces, and he includes, under this head, particularly "fish, its offal and refuse."

Another important suggestion as to public welfare is for all fish to be bled, gutted, cleaned, and dry air frozen at the place of capture. This would do away with many of the evils complained of, and is, moreover, a feasible business project. The author's investigations on this point warrant him in stating that "every day in the year, two pounds of bled, gutted, cleaned, dry air frozen (imperishable) fresh herring (about six fish) could be profitably retailed by costermongers for one penny, or two pounds of sprats for one halfpenny."

A sharp arraignment of the "Billingsgate Ring," which Dr. Hamilton accuses of diminishing the market supply of fish, in order to keep up the price, by getting the fish destroyed at various places along the coast, and a brief description of the "koshering" process for preserving animal food, closes this interesting paper.

The idea embodied in the article is, that foul fish is one of the most unwholesome, disease-producing factors in existence, but the conditions that result in such food being put upon the market are not necessary, but are due to ignorance, carelessness and greed, and can be remedied at no great expense. (Bull. U. S. Fish Commission, vol. xiii, pp. 311-334.)—Amer. Naturalist.

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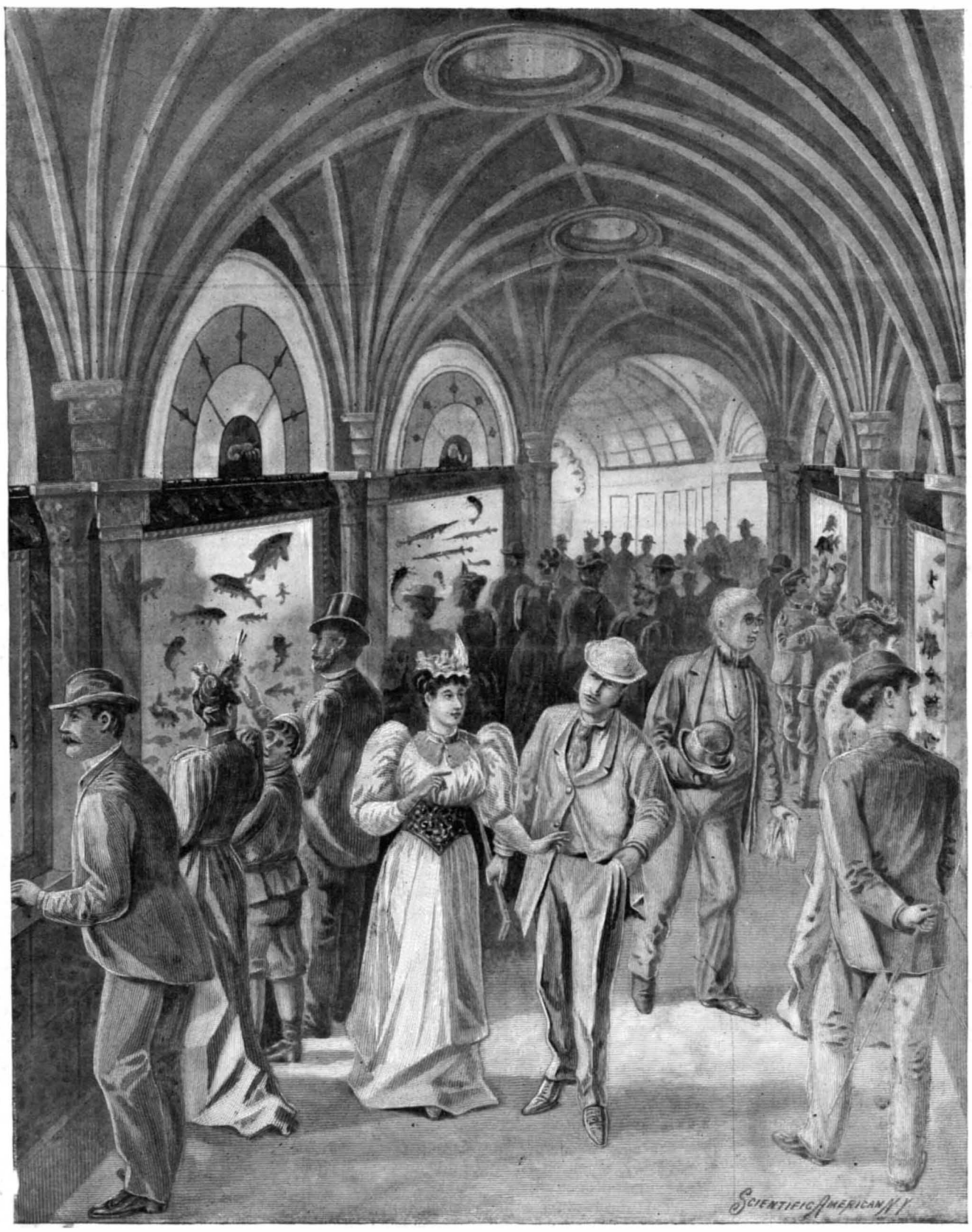
THE ATLANTA EXPOSITION.

(Continued from first page.)

obtained by looking eastward across the lake, or Clara Meer. Our engraving, the view of which was taken from this point, shows the design of the architect, Mr. Bradford L. Gilbert, to great advantage. The total length of this building is 262 feet, with a width of 85 feet. Exhibits of the latest electrical novelties are shown here, including a large contribution from the Bell Telephone Company's works.

In one of the corners of the Government building is an exhibit of the United States Fish Commission, which forms the subject of the large view on this page. Tanks of fresh water on one side of the walk and salt water upon the other side of the walk, both being lighted from the outside, are filled with rare and beautiful varieties of fish and turtle, affording a novel and interesting comparison, of which the sightseers seem never to tire.



THE ATLANTA EXPOSITION—UNITED STATES FISH COMMISSION EXHIBIT.

A Mountain Railroad in India.

A mountain railroad of great strategic value has just been completed by the British government in the Indian frontier. It runs through the famous Bolan Pass—in which so many English soldiers have perished—to the important post of Quetta. Ten years ago a railroad was opened from Sibi to Quetta, but this has proved a complete failure, in consequence of frequent landslides. The new road runs over the old one at the start and finish, but the sixty miles in the middle, which traverse the pass, constitute a short cut, and have been constructed in the face of extraordinary engineering difficulties. The highest point of the line is at Kolpur, 5,463 feet above Sibi, and seventeen tunnels, varying from 100 to 1,000 yards, have been cut through rock or clay where the foundation seemed surest. Of these tunnels, that through the Panir Hill was the most difficult and important. It is 1,000 yards in length. If the tunnels on this line are important, the bridges are not less so, the main object to be achieved being the defeat of the Bolan River, which when flooded becomes a torrent, sweeping all embankments and bridges before it. There are many bridges of only a few yards in length, but the two most important are those called the Hanar and the Ocepur. These are each more than 150 yards in length, and they are 65 feet above the river when in torrent, and are practically secure against the worst floods. To give an idea of the difficulty of the route it may be mentioned that in the most difficult section of all—between Hirok and Kolpur—the Bolan ravine is crossed nine times in four miles.

Electric Funeral Trains.

Managers of Chicago electric street railways are preparing to cater to funeral parties. Somber colored cars will take the place of hearses and the mourners will follow in trailers instead of carriages. The Calumet Railway Company will have a funeral car running in about a month. The car above the trucks will be black, and the trolley pole will be wound with crape. Inside the car, just back of the motorman, a bier will occupy one side. Opposite this are to be seats for the minister and pallbearers. The mourners will sit along the sides of the car. The motorman and conductor will be uniformed in black.

The Cost of the New American Torpedo Boats.

The contracts for the 24½ knot torpedo boats for the American navy have, according to a correspondent of the Glasgow Herald, been given out. Two of them are to be built by the Herreshoffs according to their own design, although it was stipulated originally that the Navy Department designs were not to be departed from. Their price is $140,000 for each. The third is to be constructed by Moran Brothers, of Seattle, Washington State. The price to be paid Messrs. Moran is $160,000. The displacement is 130 tons, and the engines, triple expansion, are to develop 2,000 horse power at 412 revolutions. They are to be four cylinder, 12 inch, 19½ inch, and two of 22 inch diameter by 1 foot 4 inch stroke. The boilers are of the water tube type, the grate area being 95 square feet and the total heating surface 5,120 square feet. The total of machinery, including everything, is restricted to 60 tons. The engines, although vertical, are not to be placed opposite each other, as is the universal practice, but in separate compartments, the one abaft the other, as with the old horizontal engines. The correspondent referred to adds that we have recently added to our navy ten first-class torpedo boats of 144 tons displacement, with twin screw triple expansion engines, giving a speed of 23½ knots. The average price paid was $72,455, so that for the price being paid for the three, the United States could get from British builders, even allowing for the difference in speed, five boats.

Improved Land Registration.

Next in importance—next greater, perhaps—to these party contests in so many States was the vote in Cook County, Ill., in favor of the introduction into the United States of the Australian system of land registration. This system, which for years has been advocated by all disinterested men familiar with its workings, provides for the public registration of titles and public guarantee of their validity. When the title to a piece of property is once searched by public officials, the owner receives a certificate of ownership, a copy of which is placed upon the public records. Thereafter this piece of property can be transferred with as little trouble or expense as personalty. It is not necessary again and again to employ lawyers to search the title, and the purchaser or mortgagee is absolutely certain that his property will not be swept from him or become the subject of litigation. When the property is sold or mortgaged, the fact is entered upon the certificate and also upon the county records, and it may change hands until the certificate is canceled and a new one issued, without further cost or danger to the possessor. When the system was first introduced into Australia, a moderate fee was required for the guarantee of titles, but the number of public losses was so much smaller than expected, and the guarantee fund grew so rapidly, that the fee was reduced to a few shillings. In Chicago the registration fee will be two dollars, and the fee for guaranteeing the title will be one dollar for each thousand dollars' worth of property. The guarantee fees being proportioned to the value, small holdings can be acquired almost as cheaply as large. A strong effort was made to introduce the system into England in 1889, but was defeated by the solicitors, who openly resisted the measure as "an attack upon their interests and privileges." When this intellectual labor union to prevent the use of labor-saving machinery was successful, the London Economist served notice upon the legal fraternity that its victory was only temporary, and that the agitation would not stop until real estate had been made as easily transferable as personalty. In England this prediction is as yet unfulfilled, and in America, where a similar agitation has been renewed year after year, the first legislative victory was the law passed in Illinois last winter permitting counties to introduce the system if a majority of the voters so ordered. In Chicago the Real Estate Exchange had been demanding the introduction of the system for several years, and was a powerful enough body to secure the reference of the question to the people. The result indicates that the Australian land registration system may rapidly attain a popularity equal to that of the Australian ballot system. The vote stood: "For, 82,507;" "Against, 5,308." Conservatives as well as Liberals, and rich as well as poor, were practically unanimous in support of a measure to remove the legal barriers to the wider distribution of real property and make its possession more valuable and more secure.—The Outlook.

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THE STEAMER ST. PAUL.

We give an engraving from a photograph of this new and splendid steamer which lately has taken her place on the American line of steamers plying between New York and Southampton.

The St. Paul is a sister ship of the St. Louis, launched in November last, and both are, in the words of Mr. Charles H. Cramp, "American from truck to keelson. No foreign materials enter into their construction. They are of American model and design, American material and built by American skill and muscle."

They are the largest vessels ever constructed in America, their principal dimensions being: Length over all, 554 feet; length on load water line, 536 feet; extreme breadth, 63 feet; moulded depth, 42 feet; tonnage, gross register, 11,000 tons. The hull has a double bottom constructed on the cellular principle, subdivided by athwartship bulkheads and a longitudinal division arranged for heeling purposes, the whole available for water ballast. It is so subdivided by transverse bulkheads that even in the event of a collision and injury to a bulkhead, whereby two compartments might fill with water, the ship would still float in perfect safety. It has a straight stem and elliptical stern, topgallant forecastle and poop, with close bulwarks fore and aft, and promenade, saloon, upper, main and orlop decks, the three first named to be plated from end to end. The main deck will be plated for the length of the machinery spaces, and will have stringers and tie plates beyond. Wood planking will be laid on all decks. The promenade deck will remain unbroken the whole length of the vessel. The vessel will carry about 320 first-class and 200 second-class passengers and 900 emigrants.

The engines are quadruple expansion, designed to develop 10,000 I. H. P. each. The cylinders are 36, 50, 71, and 100 inches respectively in diameter, with a piston stroke of 60 inches, two sets of engines turning twin screws, which will be sectional, with three blades. Steam for the working of the main engines will be furnished at about 200 pounds pressure by six steel double-ended boilers, each 20 feet long and 15 feet 7½ inches diameter. When working under ordinary seagoing conditions, the vessel is easily capable of maintaining a speed of 20 knots per hour at sea.

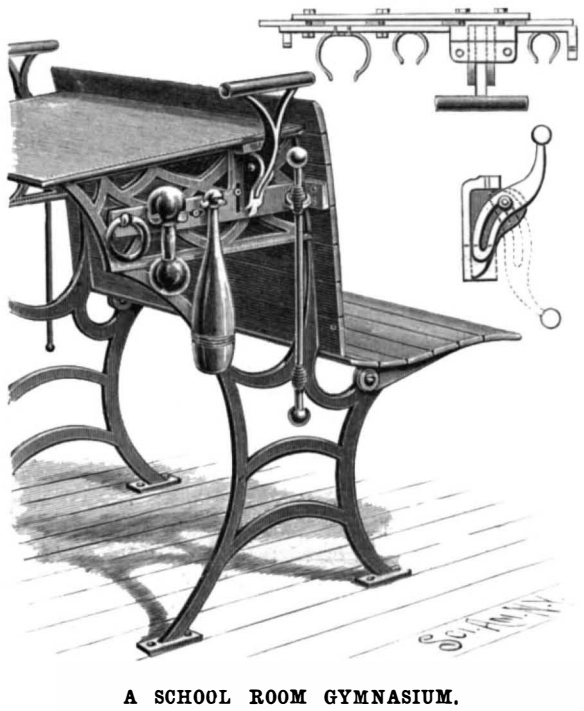
The St. Paul has been especially arranged to be readily and quickly convertible into an armed cruiser of the United States government, in which capacity she will carry a number of six-inch rapid fire guns.

House Numbering.

Berlin is preparing to fete the hundredth birthday of the house number. In the London and Paris of a century ago ciphered houses did not exist. The coat of arms, the house name or the sign board were the only indications to guide our ancestors' wandering feet by day or dark. "Watchman, what of the night, and where the deuce am I?" must often have been the cry of these bewildered minds. Berlin began to number houses in 1795. Starting from the Brandenburg gate, the Prussian ediles counted straight on to infinity, neither beginning afresh with fresh streets nor numbering the houses by odds and evens. Vienna adopted the latter reform in 1803 and Paris followed in 1805.

A SCHOOL ROOM GYMNASIUM.

Educators seeking means by which to promote, with convenience and economy, the physical as well as the mental training of those in their charge, will be interested in the school room arrangement of gymnastic appliances shown in the accompanying illustration.



A SCHOOL ROOM GYMNASIUM.

The improvement forms the subject of a patent issued to Mr. Theodore Bessing, the manufacturers and owners being the School Gymnasium Company, of No. 226 South Spring Street, Los Angeles, Cal. The appliances comprise ring, wand, dumb bell, bar bell, and horizontal and parallel bars, the latter being very simply adjusted and dropped out of the way altogether, as indicated by dotted lines in one of the small figures. Another view is a section representing the attachment of the bar bracket and combination rack to a desk. The whole arrangement is compact and does not project into the aisle when not in use. The improvement has received the warm commendation of numerous teachers and school superintendents.

A Great Sailing Ship.

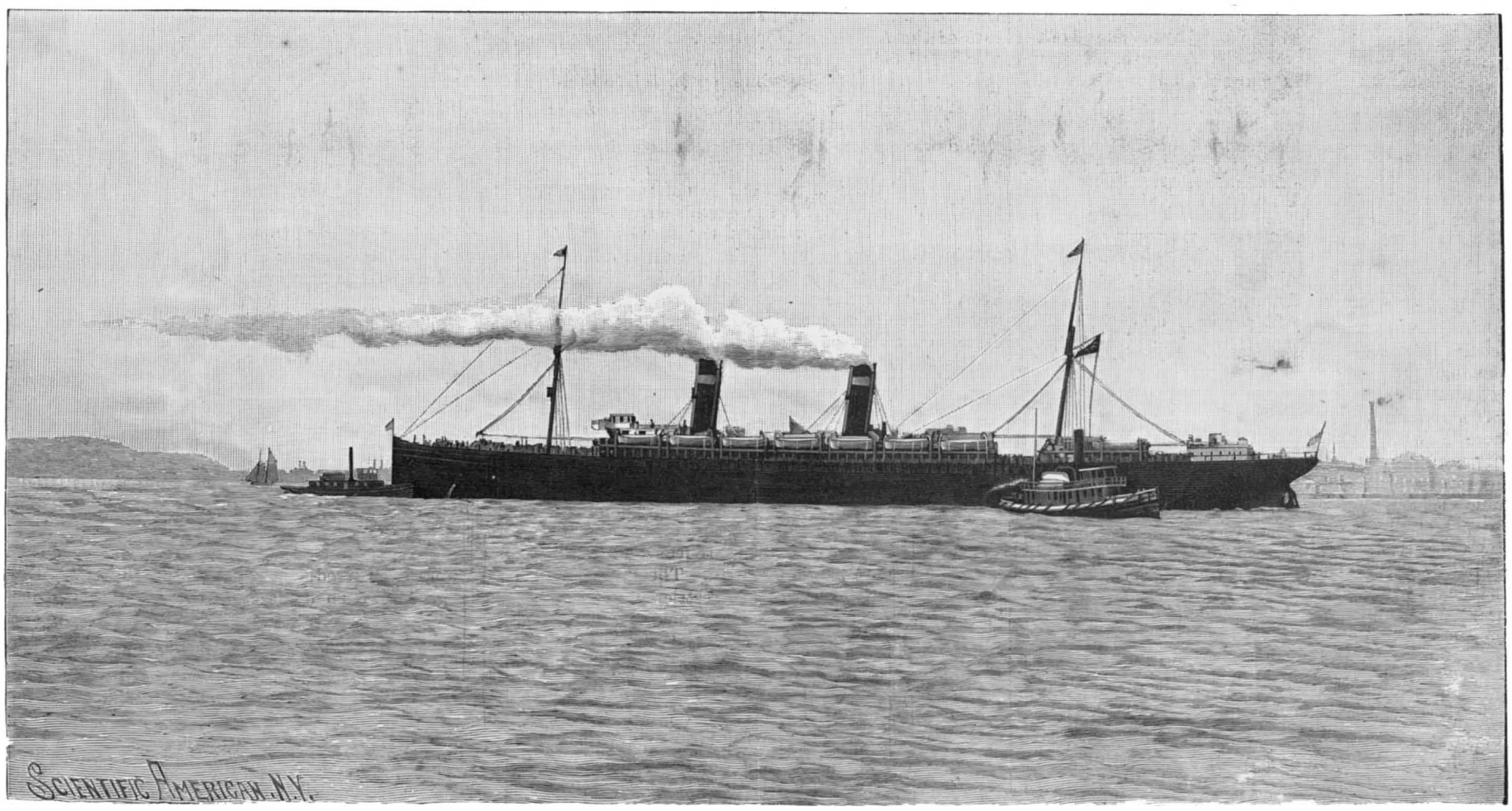
The Seaboard relates a curious incident with regard to the iron vessel May Flint, said to be the largest sailing ship that ever entered the port of San Francisco. She is 361 ft. long, 43 ft. beam, 25 ft. in depth, has a registered tonnage of 3,287 tons, and was carrying at the time of the occurrence referred to 4,320 tons of coal, which brought her down in the water 23 ft. Her commander, Captain E. D. P. Nickels, reports that during a recent voyage his ship encountered head winds and the usual rough weather near Cape Horn, losing her three topgallant masts, three topsail yards and a number of sails, which were blown away. The passage from the equator was quite uneventful until the ship arrived off the port of San Francisco. The wind failing, the vessel drifted north close to Bodega Heads. Captain Nickels tried to work her round the point into Bodega Bay, but was unable to manage the great becalmed ship. So he let go the starboard anchor about half a mile from the beach. The wind was so light that the anchor held the ship, though she had only about nine fathoms of water under her stern. At this point the steamer Alice Blanchard came along, and seeing the great ship in such a dangerous position, offered to tow her off for $12,000! Such a sum for throwing a hawser to the bow of a drifting ship on a calm day was a modest demand, to say the least of it. The demand then fell suddenly to $5,000. Captain Nickels offered $160 for the end of a tow rope, but the steamer, blowing her whistle as a salute, passed on, and her captain now passes as the meanest man on the coast.

Liquefaction of Gases.

Olszewski recently succeeded in producing a momentary liquefaction of hydrogen by allowing it to expand suddenly from 140 atmospheres' pressure, when cooled to about —210° C. with liquid air or oxygen boiling under a pressure of less than 20 mm. Its boiling point under atmospheric pressure was found to be—243·5° C., only 30° above absolute zero. In a letter to Ramsay (Nature, October 3) he now announces that under the same conditions helium shows no sign of liquefaction. Its boiling point is therefore still lower than that of hydrogen, and it is the most volatile substance known. In view of the great difficulty in reaching still lower temperatures, it would seem that the present methods will have to be considerably improved before helium can be liquefied.

Staining Wood Black.

A process that is much employed for the above purpose consists in painting the wood consecutively with copper sulphate solution (1 per cent) and alcoholic aniline acetate (equal parts of alcohol and acetate). A very durable black—and the nearest approach to real ebony—is readily obtained by moistening the surface of the wood with dilute sulphuric acid (1:20), and subsequently applying heat. A temperature of 60°—90° C. suffices in a very few minutes to produce the desired result. An excellent black was obtained in this way on beech, bass, and boxwood; while a second treatment with acid was necessary in the case of cherry, walnut, and birch. With oak and ash the results were not so good; and apple, and different varieties of pine, were still less amenable to the process, pine especially being unevenly stained. In order to afterward remove the acid from the wood, it might be well to thoroughly wash the latter with dilute soda solution, followed by clean water. It is unlikely that this method can be applied to any but small articles, because of the risk of possible fractures during the necessary heating of the wood.—Badische Gewerbe-Zeitiung.



THE NEW STEAMER ST. PAUL OF THE AMERICAN LINE.

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Who Has the Largest Bible?

The Evening Telegram puts the above query, and then proceeds to state that that of the Buddhists is in 325 volumes and weighs 1,625 pounds.

These sacred books are perfectly appalling in their bulk. They are called the Tripitaka, the Three Baskets, and were originally written in Pali, a vernacular form of Sanskrit. They have been translated into many languages, such as Chinese, Thibetan and Mandshu. They have also been written and published in various alphabets, not only in Devauagarie, but in Singhalese, Burmese and Siamese letters.

The copy in nineteen volumes lately presented to the University of Oxford by the King of Siam contains the Pali text written in Siamese letters, but the language is always the same; it is the Pali or vulgar tongue, as it was supposed to have been spoken by Buddha himself about 500 B. C. After having been preserved for centuries by oral tradition, it was reduced for the first time to writing under King Vattagamani, in 88–76 B. C., the time when the truly literary period of India may be said to begin. But besides this Pali Canon there is another in Sanskrit, and there are books in the Sanskrit Canon which are not to be found in the Pali Canon, and vice versa.

According to a tradition current among the Southern as well as the Northern Buddhists, the original Canon consisted of 84,000 books, 82,000 being ascribed to Buddha himself and 2,000 to his disciples, writes Max Muller in the Nineteenth Century. Book, however, seems to have meant here no more than treatise or topic.

But, as a matter of fact, the Pali Canon consists, according to the Rev. R. Spence Hardy, of 275,250 stanzas, and its commentary of 361,550 stanzas, each stanza reckoned at thirty-two syllables. This would give us 8,802,000 syllables for the text and 11,569,600 syllables for the commentary. This is, of course, an enormous amount: the question is only whether the Rev. Spence Hardy and his assistants, who are responsible for these statements, counted rightly. Professor Rhys Davis, by taking the average of words in ten leaves, arrives at much smaller sums, namely, at 1,752,800 words for the Pali Canon, which in an English translation, as he says, would amount to about twice that number, or 3,505,600 words. Even this would be ample for a Bible; it would make the Buddhist Bible nearly five times as large as our own; but it seems to me that Spence Hardy's account is more likely to be correct. Professor Rhys Davis, by adopting the same plan of reckoning, brings the number of words in the Bible to about 900,000. We found it given as 773,692. But who shall decide?

What the bulk of such a work would be we may gather from what we know of the bulk of the translations. There is a complete copy of the Chinese translation at the India Office, in London, also in the Bodleian, and a catalogue of it, made by a Japanese pupil of mine, the Rev. Bunyiu Nanjio, brings the number of separate works in it to 1,632. The Thibetan translation, which dates from the eighth century, consists of two collections, commonly called the Kanjur and Tanjur.

The Kanjur consists of 100 volumes in folio, the Tanjur of 225 volumes, each volume weighing four or five pounds. This collection, published by command of the Emperor of China, sells for £630. A copy of it is found at the India Office. The Buriates, a Mongolian tribe converted to Buddhism, bartered 7,000 oxen for one copy of the Kanjur, and the same tribe paid 12,000 silver rubles for a complete copy of both Kanjur and Tanjur. What must it be to believe in 325 volumes, each weighing five pounds—nay, even to read through such a Bible!

The Formation of Coal.

Carbon is the principal element in the composition of coal. A good specimen of hard dry anthracite would show from 91 to 98 per cent of carbon. The average anthracite of commerce, known technically as semi anthracite, would show from 85 to 90 per cent, and the bituminous and semi-bituminous varieties would range all the way from 50 to 85 per cent. The amount of volatile matter contained increases from three per cent in the anthracites to 38 per cent in the bituminous species. The conduct of these different kinds of coal in combustion gives practical emphasis to the difference in composition. The anthracites burn with a small blue flame of carbonic oxide until thoroughly ignited, give off no smoke, and leave a comparatively small percentage of ashes. The bituminous classes, on the other hand, burn with a continuous yellowish flame, give off considerable smoke, and leave a large percentage of ashes.

That coal is a vegetable product may be specifically proved. Indeed, ocular demonstration may be had of that fact. For while to the naked eye the structure of a fragment of mineral coal is purely amorphous, yet if that fragment be made so thin that it will transmit light, and if it be then examined through a powerful microscope, its vegetable structure will be readily distinguished. Heat, pressure and confinement have produced the transformation. It is simply a process of smothered combustion. The operation may be watched in any peat bog. A peat bed is simply an accumulation of the remains of plants which have grown and decayed, and have been year by year buried more deeply under succeeding growths. Remove the upper layer, and you find peat with its 52 to 66 per cent of carbon. The deeper you go, that is, the older and longer buried the product, the better will be its quality for fuel. If this process of deposition should continue through many geologic ages, the result would doubtless be true coal.

It is known that during the carboniferous age the area now covered by the Middle, Southern and Western States was little more than a vast marsh burdened with the most luxuriant vegetation. The conditions were all favorable for the rapid and enormous growth of plants. The soil was rich and moist. The heat was greater than exists to-day at the torrid zone. The humidity of the atmosphere was great and constant. The air was laden with carbon. Plants luxuriated in it. They grew to enormous sizes. Plants which in our day are mere stems, a fraction of an inch in diameter, were in that time represented by trees from one to three feet in diameter and from 40 to 100 feet in height. This mass of vegetation, including more than 500 different species, was constantly growing, falling and decaying, each succeeding growth forming a still richer bed for the vegetation to follow.

If the theory propounded by Laplace is correct, our earth was at one time a ball of liquid fire. Cooling and condensation progressed from the surface toward the center. Contraction of the earth's crust necessarily followed, and vast areas of land sank and were covered by the waters. This process was still going on during the carboniferous age. The submergence of a bed of this incipient coal meant the cessation, for a time, of vegetable growth from its surface. That surface was covered instead by the sand, mud and gravel washed over it by the waves, by the drift from higher levels, and by the limestone deposits swept up to it from the sea. When contraction ceased for a time and the earth's crust again became stable, the waters began to recede, leaving behind them great wastes of mud and sand. And, following this slow recession to the sea, vegetation crept once more over the surface of the land, the soil grew rich with the products of decay, and plant life reigned and rioted anew. But cooling and contraction of the earth's body were going continuously on, and submergence followed again and again, each bed of vegetable matter, thick or shallow, being covered in turn by its layers of sand and silt.

In this submergence and burial of the deposits of the coal era we find all the conditions necessary for the transformation of vegetable matter into coal. Only from one-ninth to one-sixteenth of the mass of vegetable matter subjected to this heat and pressure was retained in the form of coal. This was largely carbon, the hydrogen and oxygen having been expelled. As we have already seen, the anthracite coal contains a much larger percentage of carbon than does the bituminous, and a much less quantity of volatile matter. Of the immense coal areas in the United States only an extremely small percentage are of the anthracite variety, and these all lie in the State of Pennsylvania, east of the Allegheny Mountains, with the exception of a small field in Rhode Island. It is not thought that the vegetable life which entered into one class differed in any material respect from that which entered into the other.

The presumption is natural, if not conclusive, that prior to the close of the carboniferous age all the coal deposits had been bituminous in character, but that the violent movement of the earth's crust at the time of the Appalachian revolution, the enormous pressure and intense heat, were sufficient to expel a large portion of the volatile matter from the bituminous coal beds, and otherwise change their character into what we now class as anthracite. In the slate strata immediately overlying each coal seam, it is common to find the impressions of twigs, nuts, seeds, leaves, the most delicate fern tracery, and the trunks of great trees mashed flat between the layers; while in the softer beds of cannel coal, whole trees have been found, roots, trunks, branches, leaves, seeds, and all transformed into like material with that by which they were surrounded. One of the results of the violent disturbances of the earth's crust already noted was to leave great rents in it across the lines of strata. These rents are known geologically as fissures. They have faces which are either parallel or inclose a wedge shaped cavity. Sometimes igneous rock from the molten mass below was forced up into these openings; sometimes the cavities were filled with drift and rock fragments from the surface. In either case the mass became hard and compact, but with a character materially different from the rock on either side, the formation of which was contemporaneous with that of the coal.

The mind must exert itself to the utmost in order fully to realize through what vast periods of time the processes were continued by which the coal of to-day was formed. Still more difficult of comprehension is the fact of the enormous amount of vegetable matter which entered into the composition of these beds of coal. In the Pottsville regions in Pennsylvania the average thickness of the combined anthracite coal seams is 120 feet. In order to make up this quantity of resultant coal, there must have been an average thickness of vegetable deposit amounting to at least 1,200 feet.—New Science Review.

Graduating Glass Measures.

Graduations on glass bottles, measures, etc., may be easily engraved with the aid of a few small files, a set of six of which, of various shapes, can be bought at most tool shops for about one shilling. A small bottle of turpentine in which some camphor has been dissolved is also very useful as a lubricant, although it is not absolutely necessary.

Suppose it is wished to graduate a bottle which will hold about ten ounces or half a pint of water. First fix a strip of gummed paper, about three-quarters of an inch wide, vertically on the outside of the glass, taking care that it is long enough to come slightly above the place where the ten ounce mark will be. When the gum is dry and the paper slip firmly secured to the glass, pour exactly ten ounces of water into the bottle, place the latter on a flat table, and when the surface of the water has become level and perfectly steady mark the height in pencil on the paper strip. Now take a dry graduated two-ounce measure, pour two ounces of water from the bottle and mark the level of the eight ounces remaining; in the same way register the position of the six, four and two ounce marks. Then empty the bottle and proceed to refill it at one ounce at a time, marking the level of the water at each addition; every second ounce ought to agree with the marks made at first, and in this way the correctness of the measurements will be checked.

When satisfied with the accuracy of the graduations, file with one edge of a fine triangular file through the paper where each mark occurs, until you feel that the tool is cutting into the glass. The marks can be made any length you please; the file cannot slip, as the paper will keep it in the proper place. When all the lines have been well cut in, the paper can be removed and the marks deepened or made wider by using a differently shaped file; the angle of a square or the edge of a very thin flat one dipped in the turpentine and camphor will make good broad lines that can easily be seen. If it is wished to number the graduations, Roman numerals are the easiest to make, but they should all be penciled on the paper and cut through, as before described. It will generally be found on trial that two or three of the small files will easily cut the surface of the glass when used at the point like pencils; and in this case any sort of numerals or letters can easily be engraved, provided that they are first started through the paper.

The turpentine should not be used until the paper has been removed, as it is important to keep the latter dry, but afterward the files will work much more easily and quickly with the aid of the lubricant. If thick, bold lettering is required, it should be drawn on the paper and the thick lines removed with a sharp pointed penknife. In most cases it is better to cut through all pencil lines with a sharp knife before filing, as this prevents the files from becoming clogged.

If very broad lines are required, it is as well to commence them by making two thinner lines the proper distance apart; the surface of glass between the lines can then be easily chipped away with the end of a file.

There is not the slightest difficulty with any part of the operation excepting when elaborate writing is attempted, and even this can be easily mastered by any one who is accustomed to use the pencil. The precautions to be observed are: First mark upon the paper every line that is required to appear upon the glass, and do not remove the paper until every line has been cut, or rather scratched, on the surface of the glass. Special care must be taken to insure this in the case of lettering, as it is very difficult to remedy omissions in the absence of the paper.

Numbers or lettering will always look neater if placed between two parallel lines, which need only be lightly scratched on the glass. These will, in a great measure, prevent the tool from overshooting the mark when deepening and picking out the body of the letters, and will also insure that the latter will all be of the same height.

If these instructions are carefully carried out, with very little practice measures and bottles can be easily graduated in such a manner as to give no evidence of the work of an amateur engraver.—Photo Notes.

Tobacco Boxes.

Formerly the plugs were pressed into the boxes by powerful leverage, which necessitated great strength in the box. Most of the manufacturers now have iron or steel moulds, into which the freshly made plugs are pressed into a body just large enough to exactly and evenly fill the wooden boxes in which they are marketed. This allows the use of lighter boxes without cleats or corner pieces.

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A TREE BRIDGE.

To the Editor of the SCIENTIFIC AMERICAN:

I send a copy of a photograph of a novel bridge, which may interest your many readers.

The bridge is one Douglas fir log, 4 feet in diameter and 54 feet between supports, and is used by prospectors to cross a stream on the western slope of the Cascade Mountains.

The view shows the Washington State Road Commission crossing the structure. This photograph is one of a number of kodak views I took during the past summer while exploring a route for State wagon road across the Cascade Mountains.

B. W. HUNTOON,
Engineer State Road Commission.
Fairhaven, Wash., October 22, 1895.

A TREE BRIDGE.

Dalmatian Insect Flowers.

According to De Boisse, the active principle of Pyrethrum cinerariæfolium is a yellow resin soluble in ether, insoluble in water and very slightly soluble in alcohol, carbon bisulphide, or fatty bodies. It is readily decomposed by alkalies. To extract the active principle the author exhausts the flowering tops of the plant with ether. The principle thus extracted is described as being of the color and consistence of virgin wax, with an apple-like odor. From the fresh plants the active principle may also be extracted by macerating the finely-chopped flowering tops with half their weight of ether, vaselin oil, colza, or petroleum, according as the product is intended for medicinal or agricultural use. The mixture, after trituration, is allowed to macerate for seven or eight hours. It is then strongly pressed, the resulting liquid allowed to stand, and the supernatant yellow oily liquid separated from the watery portion, which is rejected. When prepared with vaselin oil, the oily solution is useful for human medicine, being a powerful insecticide. The solutions in colza or petroleum have a wide application in agriculture to destroy insect parasites, being applied direct to trees or shrubs. Emulsified with forty times their volume of soot water, they may be used for spraying the twigs and leaves.—Rev. de Scient. Natur.

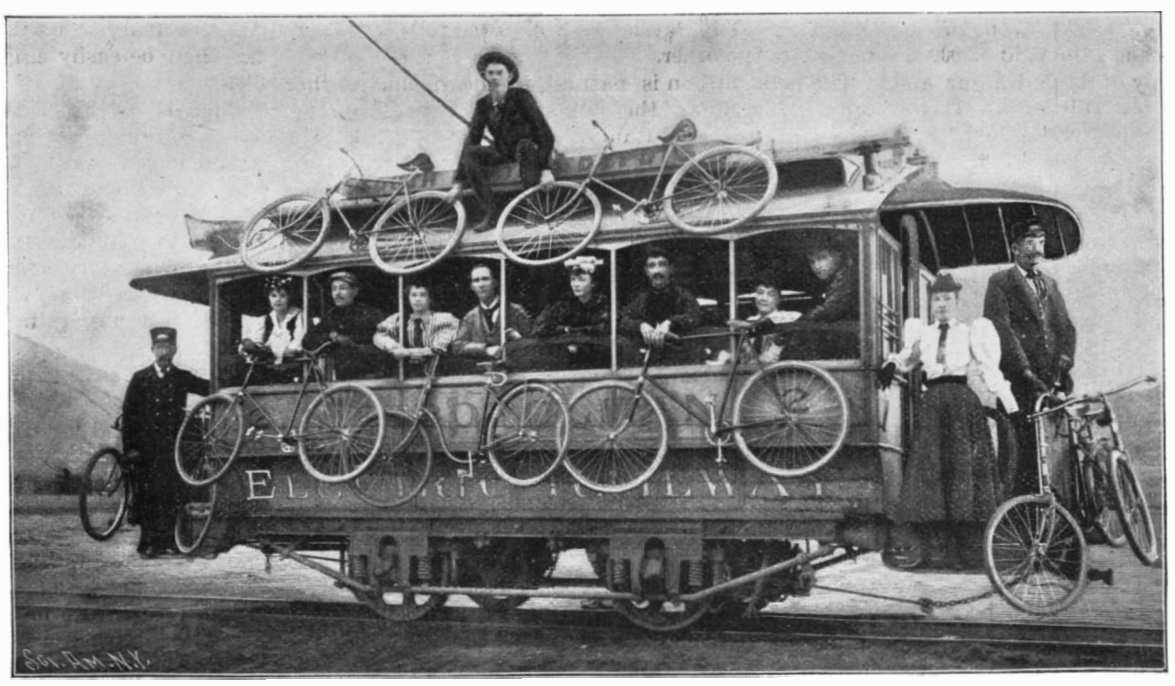
STREET CAR HOOKS FOR BICYCLES.

One of the obstacles in the way of cycling in New York City, and in other cities, is the lack of facilities for the transportation of wheels on the street cars. Hundreds of wheelers, anxious to take a morning or an afternoon spin, are deterred on account of the long and dangerous trip required over stone pavements and car tracks before the open country roads can be reached.

The street car people make no provision for the cyclers, and will not permit their wheels to be carried on the platforms. They do things differently at Butte, Montana. There the street cars are provided with exterior hooks on which cyclers may hang their wheels, as shown in our photograph. The plan is a great success and is an accommodation greatly appreciated by all lovers of the wheel. It might be adopted very easily by all street car companies and would add considerably to their revenues.

In Brooklyn, N. Y., on Sundays and holidays the elevated steam railways have become so far liberalized that they admit wheelers and their wheels to the smoking cars, a charge of two extra fares being made for the wheel. Hundreds of cyclers avail themselves of the privilege.

We are indebted to the Street Railway Review for the photograph from which our plate was made.



STREET CAR WITH HOOKS FOR BICYCLES.

Hollis W. Moore.

Hollis W. Moore died at Olean, N. Y., on November 14. He was born at North Leverett, Mass., in 1832. Mr. Moore was well known as an inventor and patentee. He was the manager of the International Steam Power Company, which manufactured his high pressure water tube safety boiler. He also invented the Black Giant shear punch and upset, the Ram's Horn spring for carriages, a patent circle for carriages, and other devices in the line of carriage work.

The Invisible Spectrum.

Dr. Huggins, in concluding his spectroscopic lectures at the Royal Institution, alluded to the wonderful advances recently made in ascertaining the character of the invisible parts of the solar spectrum. The rays of the sun, when received through the prism of the spectroscope, appear to the eye as a ribbon of rainbow colored light, across which are drawn a multitude of fine black lines, representing the screening or absorptive effect of the solar atmosphere. From the character and position of these lines the spectroscopic chemist is able to say what chemical elements in the gaseous atmosphere of the sun are causing this absorption. But this visible portion of the spectrum compasses but a fraction of the total rays that are speeding to us from the great fountain of energy upon which the life of the earth and its fellow planets depends. Beyond the violet end of the spectrum there is a whole gamut of invisible rays which only revealed themselves by their effect in promoting chemical action. Similarly beyond the other end of the visible scale—the deep red—there is a gamut of invisible or dark rays which are only perceived by their heating effects.

Some idea of the importance of the "ultra red" may be gathered from the fact that it has been traced to a distance nearly ten times as long as the whole range of the visible or light-giving region of the spectrum. To learn the character of these mysterious dark rays, then, it is clearly necessary for science to fit itself with some new sort of eyes that can see what ordinary eyes cannot—namely, heat rays and chemical rays. The photographic plate has answered admirably as an eye for the chemical rays, and brought out some wonderful facts. But with the invisible heat rays the problem was more difficult. Something in the nature of an extremely delicate thermometer is here required, which will pick out all the fine absorption lines as colder spots in the spectrum. The beautiful instrument known as the bolometer has recently been used by Professor Langley in feeling for these absorption lines, which, being regions from which the rays are stopped out, are, of course, colder than the remainder of the spectrum.

This bolometer, like all the finest applications of science, is an extremely simple thing. It is a strip of fine wire through which a feeble current of electricity is always flowing. This wire is slowly passed along the invisible gamut of the spectrum, and as soon as it comes to one of the absorption lines the spot is shown by a minute fall of temperature in the wire. This has an instantaneous effect on the flow of the electrical current. More current will pass through a cool wire than a warmer one, and the alteration is promptly shown by a delicate mirror galvanometer, which flashes its mimic signals onto a slowly revolving photographic ribbon. In this way Professor Langley has been able to pick out and locate hundreds of dark absorption lines in the great invisible spectrum which lies beyond the red.

Not only is the absorption of rays by the solar atmosphere shown by the method, but the absorption lines of the earth's atmosphere are equally apparent. Dr. Huggins anticipates that the meteorologist will soon be applying the system to weather forecasts. Some final remarks of the lecturer in regard to the photography of the corona of the sun are of interest as indicating the enormous energy which is at work in the solar furnaces. He stated that fiery spurts of calcium vapor (calcium is the metal of which quicklime is the oxide) have been photographed, extending in fantastic shapes to a distance of 280,000 miles from the sun's surface, and traveling outward at a speed of something like 20,000 to 40,000 miles an hour.

The World's Tallest Structures.

The tallest chimney was built at Port Dundas, Glasgow, Scotland, 1857 to 1859, for F. Townsend. It is the highest chimney in the world (454 feet), and one of the loftiest masonry structures in existence. It is, independent of its size, one of the best specimens of substantial, well made brickwork in existence. In Europe there are only two church steeples that exceed this structure in height—namely, that of the Cologne Cathedral (510 feet) and that of the Strassburg Cathedral (468 feet). The great Pyramid of Gizeh was originally 480 feet, although not so high at present. The United States outtops them all with its Washington Monument, 550 feet high, and the tower of the Philadelphia Public Buildings, which is 537 feet high.

The Eiffel Tower, at Paris, France, surpasses all other terrestrial metal structures with its altitude of nearly one thousand feet. The "Great Tower," for London, England, in course of construction from designs of Mr. Henry Davey, C.E., will outtop all metal structures, being built of steel, and its extreme height will be 1,250 feet when finished.

The highest and most remarkable metal chimney in the world is erected at the imperial foundry at Halsbrucke, near Freiberg, in Saxony. The height of this structure is 452·6 feet and 15·74 feet in internal diameter, and is situated on the right bank of the Mulde, at an elevation of 219 feet above that of the foundry works, so that its total height above the sea is no less than 711·75 feet. The works are situated on the left bank of the river, and the furnace gases are conveyed across the river to the chimney on a bridge through a pipe 3,227½ feet in length.

The highest artificial structure in America is the water works tower at Eden Park, Cincinnati, O. The floor of the tower, reached by elevators, is 522 feet above the Ohio River. The base is 404 feet above the stream. If the height of the elevator shaft be added to the observation floor, the grand total height is 589 feet.

The highest office building in the world is the Manhattan Life Insurance Company, of New York City. Its height above the sidewalk is 347 feet, and its foundations go down 53 feet below the same, being 20 feet below tidewater level, making a total of 400 feet. The foundations consist of fifteen masonry piers, and are carried by the same number of steel caissons. The latter were sunk to bedrock by the pneumatic process. The cantilever system was used for the foundation.—Machinery.

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RECENTLY PATENTED INVENTIONS.

Engineering.

TRACTION ENGINE.—Edward Ingleton, Pottstown. Pa. This improvement provides an endless tread for the traction wheels, of such a character that the tread of a wheel will be much enlarged over its circumference, the tread being adapted to be raised in such a manner that the traction wheel will turn practically on its own center when the engine is being steered. The elevation and depression of the tread is accomplished automatically with the operation of the steering apparatus.

FURNACE GRATE.—Edward P. Eastwick, Jr., New Orleans, La. This improvement relates to traveling grates or stokers which automatically receive their fuel and discharge their refuse, and provides means for separating the unburned fuel from the ashes. At the discharge side or end of the grate is a hopper to receive and retain ashes or refuse, and at its bottom is a valved opening and traveling conveyor, the opening being kept sufficiently closed to prevent a too free admission of air to the furnace.

WATER ELEVATOR.—John M. Trevett, Casper, Wyoming. This invention comprises a water wheel with elongated peripheral buckets having side and end openings, th latter closed by a spring-pressed valve actuated by automatic mechanism. The wheel is designed to be mounted on floats to raise water from streams for irrigating and other purposes, the construction of the apparatus being simple throughout, and it being adapted to run continuously without needing attention.

DEVICE FOR RAISING SHIPS.—John D. Cooper, Cheboygan, Mich. Submersible pontons are, according to this invention, lowered for attachment to a vessel and emptied of their contents, the mechanism for filling, lowering, and emptying the ponton being electrically controlled from a neighboring vessel. Floats on the surface are also connected with the ponton, and all the floats may be connected with and controlled by the current from a dynamo on the vessel.

Railway Appliances.

CAR SEAT.—James M. Osgood, Boston, Mass. This is a chair with reversible and reclining backs, to serve as backs and leg rests, while the backs are so divided that each chair may be formed into a tete-a-tete, with a half back facing in one direction and the other back in the opposite direction, both backs being simultaneously moved to a safety position. The backs and rests are also so arranged as to be readily adjustable and convertible into a couch or berth, the alternate chairs being raised to form upper berths, forming practically a series of staterooms with a seat in the lower part, thus giving to each berth a separate dressing compartment.

Electrical.

TELEPHONE TRANSMITTER.—Ignatius Lucas, Passaic, N. J. Two patents have been granted this inventor, according to one of which the contact disks are embedded in a filling of loose material, preferably sliver or wool as it leaves the carding machine and previous to being felted, the filling being also in contact with the diaphragm and greatly softening the sounds for transmission. According to the other improvement, a material composed of a base having granulated carbon thereon is used between the opposing faces of the buttons of telephones and similar instruments, with the carbon in contact with the buttons, to insure a uniform and perfect transmission of sonnd, even if the transmitter be in a building subjected to unusual noise and jar.

Mining, Etc.

SEPARATOR AND AMALGAMATOR.—Frank L. Fisher, Granger, Oregon. Upon a screw-threaded standard, according to this invention, is a series of wheels with threaded hubs carrying troughs of progressively increasing diameters adapted to deliver from one to the other from the top to the bottom, a spreader plate on the top of the standard delivering into the upper trough. The troughs are filled with mercury, and the tailings flow over the edges of the upper troughs into the lower ones, the sand being easily washed and the gold amalgamated.

SUBAQUEOUS MINING MACHINE.—Henry W. and William W. Smith, Portland, Oregon. According to this improvement fluke wheels are arranged upon a vertical shaft within a tubular body, the power to operate the shaft being supplied by any suitable motor, and the machine acting on the suction principle to carry upward by a strong current of water gold and other valuable minerals found in the beds of streams. The tubular body may be swung freely to place it in position for effective operation in the bed of a stream, and it and the wheel shaft may be lengthened as desired.

Agricultural.

THRASHING MACHINE.—Franklin P. Mercer, Conway Springs, Kansas. In this machine the grain is delivered to an elevator which conveys it to a riddle, through which it is passed while being subjected to an air blast to an exit at either side of the machine, as desired, the straw being passed out at one end of the machine, without possible interference with the riddle or exit for the grain. The machine has virtually two thrashing cylinders, a lower one breaking the bundles and scattering the straw, while an upper cylinder acts in conjunction therewith to thoroughly thrash out the grain.

BOLTER.—Niels Nielsen, Copenhagen, Denmark. This invention relates to bolters having a gyratory motion in a horizontal frame, and is designed to reduce or prevent irregular and injurious vibrations of the bolter frame. Automatic compensation is provided for variations in the weight of material fed to the bolter, to maintain the bolter frame in equilibrium, and upward and downward vibrations are provided against by adjusting the center of gravity in a vertical direction.

Miscellaneous.

WAGON ROAD SNOW PLOW.—Albert C. Plumley, Sherburne, Vt. A sled with long runners has at its front end a V-shaped plow, and near the rear ends of the runners, on each side, are pivoted rearwardly sloped cutter blades and wings, which may be readily raised and lowered, to cause them to engage with snow at different heights from the ground, so that the removal of a great depth of snow may be effected by degrees. Where the road is narrow, the wing and cutter blade on one side may be removed.

HOSE CLAMP AND PATCH.—Aaron H. Forst, Louisville, Ky. For temporarily repairing burst or otherwise ruptured hose, this inventor has devised a clamp and patch consisting of two narrow semicircular cast metal parts, connected by a hinge, each of the parts lined with rubber, the parts being adapted to be brought together around a hose by a cam-locking device and lever. The device is very simple and readily applied, and for use on steam or hot water pipes the packing or lining is preferably made of material other than rubber—preferably asbestos.

METAL SASH RAIL PROTECTOR.—Thomas B. Fultz and Rufus Huff, Sullivan, Ill. This is an improvement more particularly applicable to shop or show windows having large and heavy plate glass panes, the protector being designed to cover the lower rail and furnish a seat for the pane. It is provided with a gutter for receiving the water or drip from condensing vapor on the inner surface of the pane, the water being prevented from contact with the sash rail proper and conducted off outside the building.

TABLE AND RACK.—J. Emil Dryfoos, New York City. This is a combination device adapted for arrangement as an ordinary table, or which may be conveniently converted into a display rack on which goods may be advantageously displayed. The rack is raised and lowered by hand pulls, and the top of the rack may be adjusted to different inclinations.

LINE OR HAMMOCK HOLDER.—John Bohlen, Big Rapids, Mich. To effectively support and clamp clothes lines in a taut position and for holding hammocks, etc., this inventor has devised a very simple line holder, consisting of but three pieces, very inexpensively made and put together. The holder consists of a bracket plate, swivel block and clamping lever, and the device has a free lateral movement, accommodating itself to a line stretched diagonally.

RAIN WATER CONDUIT.—Walter Van Benthuysen, New Orleans, La. This is an automatically operating device which conducts the first wash of water from a roof into a vessel other than the tank or cistern, but when the roof has been thus washed off, as at the commencement of a rain, a portion of the conductor, which is pivoted, is moved to a position to deliver the remaining portion of the rainfall into the tank or cistern.

BLACKBOARD AND DESK.—Louis Doll, Danbury, Conn. This invention consists of a blackboard supporting on its under side a game apparatus, affording an educational appliance for children designed to combine study with pleasure. The board is pivotally connected at its sides with braces pivoted on a fixed support, either face of the board being readily brought into uppermost position.

MUSIC LEAF TURNER.—Frederick Leeds, New York City. This is a simple and inexpensive construction for use with a piano, organ or other instrument, or on a music stand, and in which sheet or bound music may be placed, the performer being then able to readily turn the leaves without interfering with his or her playing. Any desired number of leaf-turning arms may be employed, the arms being so placed in engagement with the leaves that different leaves cannot follow each other from suction when one of them is rapidly turned.

OFFICE DIRECTORY.—Daniel Waide, San Francisco, Cal. This is a mechanical directory for business buildings, comprising a casing with hinged glazed cover, there being hinged in the case a carrier frame which may be drawn out and supported at an angle. A head block is designed to receive the words, "floor," "room," etc., and the case is adapted to receive indicator strips of wood to receive the names, one strip being readily substituted for another as desired.

PRISM POINTER FOR TYPEWRITERS.—Walter B. Dyer, Pottsville, Pa. This device has a body section adapted for connection with the rear portion of the typewriter basket and terminates at its forward end in a yoke, from the center of which an indicator leads to the forward portion of the typewriter basket. With this improvement no disagreeable clinking sound is given out with each stroke of the type keys, and the pointer adjusts itself automatically. The device also serves as a rest or support for and assists in preventing the curling of the ribbon at the printing point.

PRINTING PHOTOGRAPHS IN COLORS.—Edward R. Hewitt, New York City. This inventor has devised a method of forming many-colored photographic prints by applying to a suitable backing a series of superposed films bearing different colors, corresponding approximately with the colors of the object photographed, sensitizing the composite film formed of the films of different colors, rendering portions of the film insoluble by exposure to light through a negative, and finally developing the picture by washing with an appropriate solvent.

DENTAL PLUGGER.—Joseph R. Jones, Ontonagon, Mich. The holder frame of this plugger is especially adapted to receive and grasp any of the usual forms of plugging instruments, and improved mechanism is provided for supporting and manipulating the mallet, so that its operation may be more readily effected and controlled by the operator. The blow given by the mallet is a sharp welding blow, differing from a spring blow, the spring being used simply to retract the mallet. The plugger may be used as a hand pressure instrument without changes or adjustments.

BLOUSE OR JACKET.—Henry Shrier, New York City. This is a garment more especially designed for boys' wear, and is arranged to permit of reversing the parts, to turn the soiled portions under and bring into view a fresh, clean surface, also changing the appearance of the garment by different trimmings and colors. The neck opening is cut low and has a detachable reversible collar, there being a reversible and detachable front piece.

CHECKREIN SWIVEL.—Julius C. Clausen, Hensall, Canada. This is a simple device readily attachable to the bridle or other strap, and which is free to turn in any direction, there being no danger of the strap separating from the swivel.

HORSESHOE PAD.—Michael Hallanan, New York City. This pad has a yielding block at the heel provided with side extensions which terminate rearwardly of the nail holes, the extensions and the shoe having squared meeting ends that are each rabbeted and lap each other. The pads are designed for use with shoes of different sizes and shapes, to prevent balling of snow, picking up nails or pebbles, etc.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

MODERN EXAMINATIONS OF STEAM ENGINEERS; OR, PRACTICAL THEORY EXPLAINED AND ILLUSTRATED. By W. H. Wakeman. Bridgeport, Conn.: American Industrial Publishing Company. 1895. Pp. 272. 12mo. Diagrams. Price $2.

This work comprises full and complete answers to 300 questions for the use of engineers and firemen, when preparing to make application for examination for United States government and State license and for the information of engine builders, boiler makers, etc. Although there are already books on the same subject, a work of this kind, when it is as practical as the present one, cannot fail to have a large number of readers. The rules and formulas are simple and are accompanied with examples. The value of the work would have been enhanced by the insertion of illustrations. The author, being a practical steam engineer himself, well knows the wants of the working engineer, and has put into this work such knowledge and information as is best adapted to their use, making it altogether one of the most complete and comprehensive guides for the busy workers in the engine room, boiler works, and machine shops that has been published.

ELEMENTS OF THE MATHEMATICAL THEORY OF ELECTRICITY AND MAGNETISM. By J. J. Thomson, M.A., F.R.S., Cambridge. New York: Macmillan & Company. 1895. Pp. 504. 12mo. 133 figures. Price $2.60.

The author is Cavendish professor of experimental physics in the University of Cambridge, the stronghold of the mathematical sciences in England. With the exception of a few paragraphs, no more advanced mathematical knowledge is required from the reader than an acquaintance with the elementary principles of the differential calculus. It is not necessary to make use of advanced analysis to establish the existence of some of the most important electromagnetic phenomena. The study of these simple cases will in the estimation of the author be of advantage even to students whose mathematical attainments are sufficient to enable them to follow the solution of the more general cases. The work will undoubtedly fulfill a useful purpose in our more advanced institutions of learning.

NOTES ON DESCRIPTIVE GEOMETRY, WITH EXERCISES. By W. L. Ames. Terre Haute, Ind. 1895. Pp. 88. 18mo. 86 figures. Price 50 cents.

It is evident to all who have taken note of the trend of the practice of mechanical drawing in the best draughting offices that the use of the third quadrant in projecting will become universal. In the study of descriptive geometry, however, with few exceptions, the first angle projection is taught. The writer, realizing that the methods taught should harmonize with the practical application in mechanical drawing as practiced, has for some time used the third angle in teaching descriptive geometry. There being no text books so arranged, notes were prepared for the student's use. These notes revised are now published.

THE ART ORNAMENTER AND MODERN SIGN WRITER New York: Excelsior Publishing House. Small 4to. Price $2.50.

This work comprises over thirty good sized plates, giving alphabets, raised scrolls and other ornaments which are useful to the sign writer. The scrolls are particularly fine. The alphabets include block, old English, Egyptian, Roman script, German text, antique, etc.

THE PRACTICAL APPLICATION OF THE SLIDE VALVE AND LINK MOTION TO STATIONARY, PORTABLE, LOCOMOTIVE AND MARINE ENGINES, WITH NEW AND SIMPLE METHODS OF PROPORTIONING THE PARTS. By W. S. Auchinloss, C.E. New York: D. Van Nostrand Company. 1895. Pp. 138. 8vo. 52 illustrations and plates. Price $2.

In the past twenty-five years this book has had a phenomenal sale, the present being the thirteenth (revised) edition. It has proved itself both a standard authority with mechanical engineers and draughtsmen and a valued text book with colleges and technical schools. In the present edition the author has carefully eliminated all abstruse formulæ, as he does not consider it advisable to use the higher mathematics for the solution of everyday problems in link and valve motion. The component parts of such motions are always compact and the distances small, consequently they do not involve such delicate angles, etc., as in astronomy and should not be so treated, but all dimensions should be computed either arithmetically or graphically by the most simple and direct processes. The fundamental principles are dealt with to the exclusion of patented devices.

ORGANIC CHEMISTRY. The Fatty Compounds. By R. Lloyd Whiteley. London and New York: Longmans, Green & Company. 1895. Pp. 291. 12mo. Illustrated. Price $1.

An excellent work on this branch of organic chemistry. It has been the aim of the author not only to give students an intelligible and connected account of the theory of the subject, but also to provide them with such information as shall enable them to gain a practical acquaintance with it. The work has a good index—a point on which English scientific books are so often at fault. The very sensible plan is adopted of printing the figures which indicate the principal reference in heavy-faced type.

YELLOW BEAUTY. By Marion Martin. Chicago: Laird & Lee. 1895. Price 50 cents.

A book for children, with six full page half tones, reproduced from paintings by Mme. Henriette Ronner, the famous painter of cats.

The 1895-96 catalogue of the Parsons Horological Institute, or School for Watchmakers, at Peoria, Ill., is a most interesting addition to the series of annual catalogues issued by colleges and technical schools. The SCIENTIFIC AMERICAN has heretofore fully illustrated and described this unique school, and the just issued catalogue affords new evidences of the wisdom of its management and the thoroughness of its course of instruction.

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NOVEMBER, 1895.—(No. 121.)

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9. Views and floor plans of two windmills, at Mount Vernon and Wakefield, N. Y. Cost complete, $1,800. Architect, Mr. Frank M. Wright, Mount Vernon, N. Y.
10. A stable at Wakefield, N. Y. Perspective elevation and floor plans. Architect, Mr. Ralph N. Cranford, Wakefield, N. Y. An original design.
11. Miscellaneous Contents: Hints to readers.—The education of customers.—The echo organ at Westminster Abbey.—The Mascot heater, illustrated.—Carlisle's burglar proof window sash lock, illustrated.—Steam pipe and boiler covering, illustrated.—A large shipment of roofing slate.—Moving a masonry house.—The "Royal" door check and spring, illustrated.—An improved window screen and awning, illustrated.—An improved steam heating boiler, illustrated.—Improved woodworking machinery, illustrated.—Painting iron work.—A new and powerful elevator, illustrated.—Cheap flour or middlings in paint.

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(6663) J. W. D. asks: In a tug of war ten men of equal strength are pulling upon each end of a rope. Is the strain upon the center of the rope equal to the pulling power of the men at one end or both ends of the rope? A. One of the laws of mechanics, is, that antagonistic forces balance each other in proportion to their value. They are therefore not cumulative and cannot produce a greater strain in the connecting medium than is due to the greater of the forces.

(6664) E. J. T. writes: The walls of our church are built of brick, thirteen inches thick, rough cast with mortar on outside and plastered on inside. The inside walls are frescoed. When we have several days' rain the dampness goes through the walls, and thus ruins the frescoing. Can you give us any receipt for a preparation to go on the outside of the walls to prevent this? A. The best treatment of the outside surface of your church walls is to give it a thorough coat of boiled linseed oil, brushed on, and left for a few days to dry. Then if the color is objectionable, paint with any desired color.

(6665) W. M. B. says: Please inform me through your columns the necessary area of a parachute to support a man who weighs 200 pounds. A. The size or area of a parachute for dropping to the earth depends upon the velocity at which a person can land with safety. For 200 pounds at the rate of 5 miles per hour an area of 1,600 square feet, or about 45 feet diameter, will be required for the necessary resistance to the air at that speed. If a landing can be safely made at a velocity of 8 miles, or about 11 feet per second, an area of 615 square feet, or only 28 feet diameter, will be required. Parachutes should be umbrella shaped, as that shape affords the greatest resistance.

(6666) J. W. W., Manheim, Pa., asks: What is the present greatest elongation, east and west, of the north star? Its declination and azimuth compared with true meridian and variation of the compass, whether east or west? And, also, whether this variation is increasing or decreasing? A. The elongation of Polaris for the present year for the fortieth parallel is 1° 38·1′, with a yearly decrease of four-tenths of a minute. Polaris is on the meridian when Mizar, the second star from the end in the handle of the Dipper, is vertical with it, and is above the pole when the Dipper is below, or Polaris is on the farther side of the true pole from Mizar. The variation of the magnetic needle at your place for this year is about 5° 30″ west, increasing about four minutes per year.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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November 19, 1895,

AND EACH BEARING THAT DATE.

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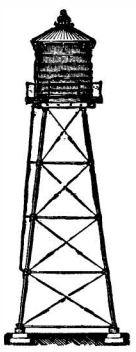

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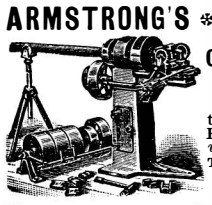

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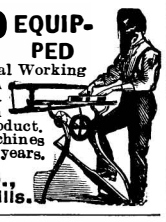

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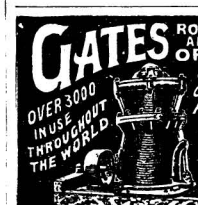

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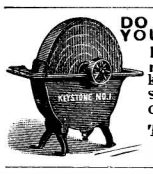

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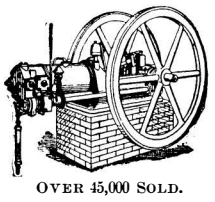

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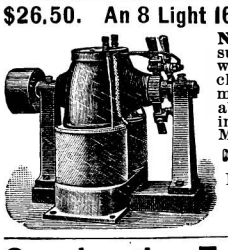

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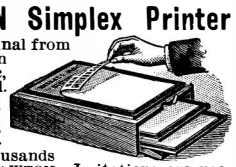

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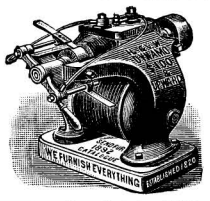

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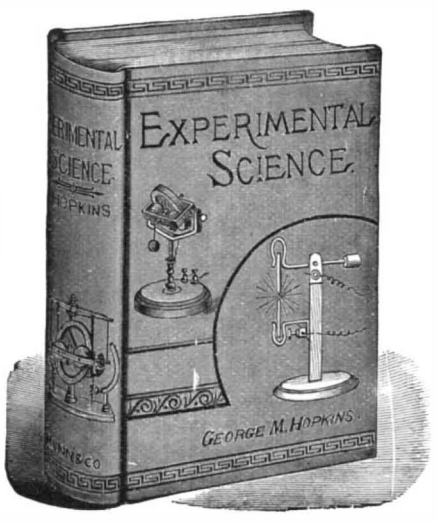

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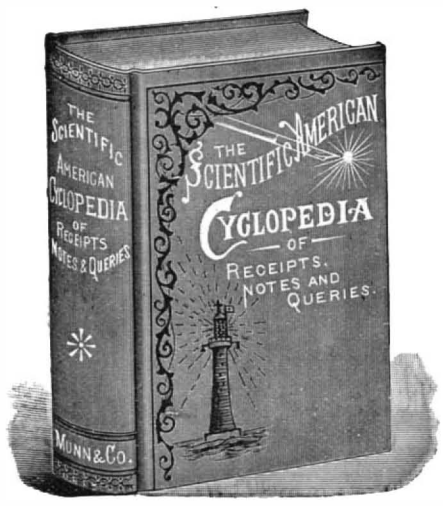

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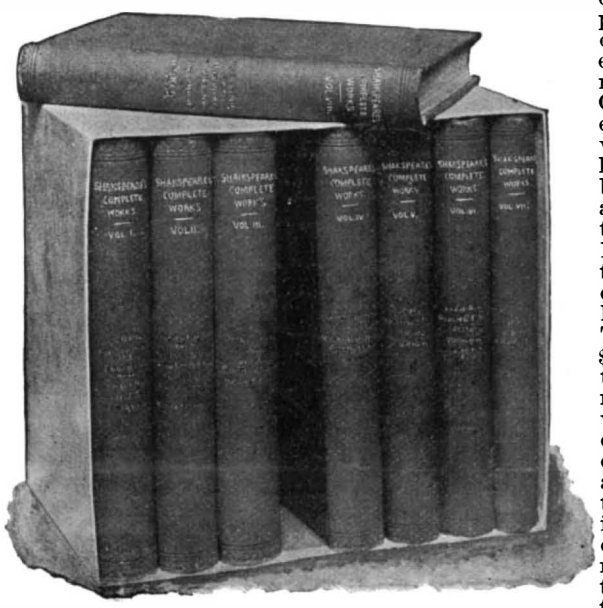

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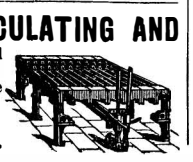

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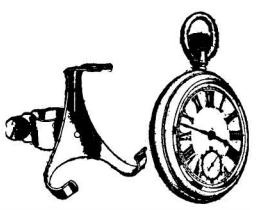

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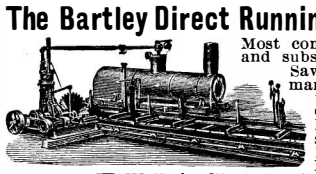

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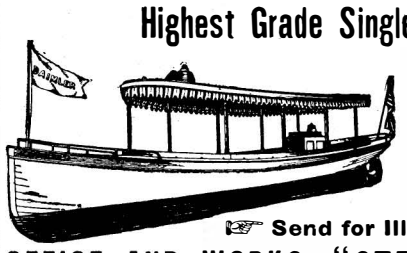

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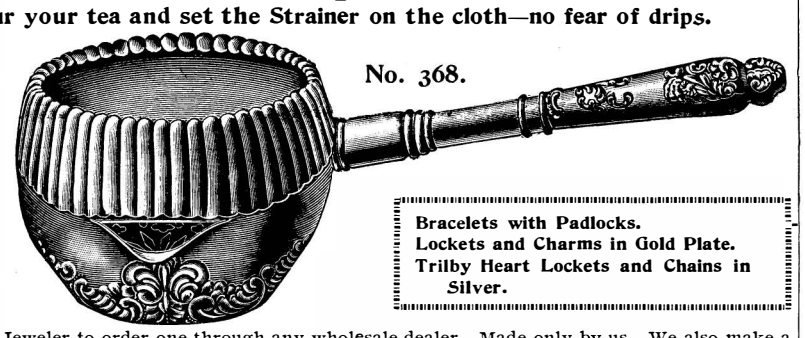

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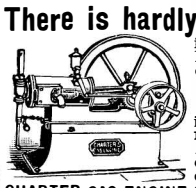

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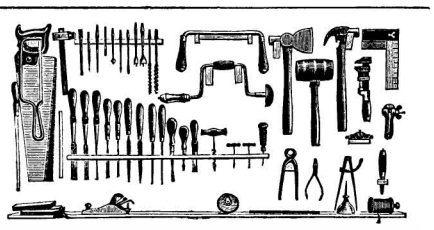

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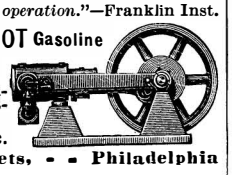

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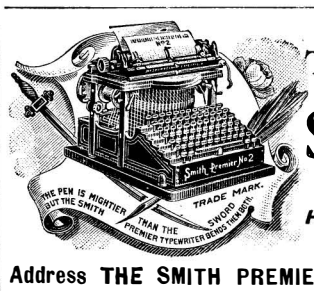

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